OXYUROID PARASITES OF ARTHROPODS.

A MONOGRAPHIC STUDY.

by

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I. FAMILY THELASTOMATIDAE.

INTRODUCTION.

As far as the writer is aware, the first oxyurid from arthropods was Oxyurus gryllotalpae, recorded in 1837 by Dufour (40) from a mole cricket; however, his description and diagram are not detailed enought to permit of its being otherwise recognised. The first forms which are identifiable are those described in 1838 and 1847 by Hammerschmidt (47, 48). His work was followed by that of a number of other workers, particularly that of Leidy (51, 56), Györy (46), Grãeffe (45), Galeb (43, 44), von Linstow (58-60), Meyer (62), Parona (63), Cobb (33-35), Johnston (50), Skrjabin (73, 74), Sergiev (71), Travassos (85-86), Pessoa and Correa (65), Schwenk (70), Artigas (1-4), Chitwood (20), Christie (27), Chitwood and Chitwood (21), Pereira (64), and Basir (5-13).

In the present paper the author has attempted a complete revision of the existing genera and species belonging to the family Thelastomatidae and has redescribed every species, giving adequate diagrams as far as possible. Three new genera have been proposed: Schwenkiella to contain Thelastoma robustum (Leidy, 1850), and T. icemi (Schwenk, 1926); Johnstonia to contain T. alatum (Johnston, 1914), Oxyuris myriapodicola Skrjabin, 1916, and T. crimense Skrjabin, 1923; and Linstowiella to contain Oxyuris lanceolata v. Linstow, 1883. Three genera, Fontonema Chitwood, 1930, Mirziella Basir, 1942, and Chitwoodiella Basir, 1948, which had been included in the family Thelastomatidae have been transferred to the family Oxyuridae. The genera Galebiella Basir, 1941 and Zonothrix Todd, 1942, are regarded as synonyms

of the genus Pseudonymous Diesing, 1857, and the genera Periplaneticola Basir, 1940, Gryllocola Basir, 1942, and Talpicola Basir, 1942 as synonyms of the genus Binema Travassos, 1925.

In 1920 Travassos (83) proposed two families Lepidonemidae and Isakidae to contain all the oxyurid parasites of arthropods, dividing the former into two sub-families, Lepidoneminae and Hystrignathinae. In 1926, Baylis and Daubney (15) suppressed both Travassos' families and divided the genera previously placed in these families among the Oxyuridae and Rhabditidae. The genera Aorurus Leidy, Thelastoma Leidy, and Pseudonymous Diesing were placed in the sub-family Oxyurinae, Isacis Lespès in the sub-family Cosmocercinae, and the remaining genera, Protrellus Cobb, Blattophila Cobb, Cephalobium Cobb, Lepidonema Cobb, Heth Cobb, and Hystrignathus Leidy in the sub-family Rhabditidae.

In 1929, Travassos (86) revised his previous classification, restricting the family Lepidonemidae to three genera, Lepidonema Cobb, Hystrignathus Leidy, and Pulchrocephala Travassos, and suppressing the sub-family Hystrignathinae Travassos, 1919. He proposed a new family, Thelastomidae, to contain all the remaining genera of Oxyurid nematodes of arthropods except for the genera Isacis Lespès, 1856, Rhigonema Cobb, 1898, and Icthyocephalus Artigas, 1926, which he retained in the family Isakidae. He divided the family Thelastomidae into four sub-families, Thelastomatinae, Aorurinae, Oniscicolinae, and Ransomnematinae.

In the same year, Artigas (3) divided the family Isakidae into two sub-families, Isakinae and Icthyocephalinae,

the latter being primarily to accommodate the genus Icthyocephalus Artigas, 1926. In the following year (4) he suppressed the name Isakidae, replacing it by Rhigonemidae because of the suppression of the generic name Isacis by Christie and Cobb (32).

In 1932, Chitwood (20) merged the family Lepidonemidae with the Thelastomatidae; he recognised three sub-families of the Thelastomatidae-- Thelastominae, Hystrignathinae, and Protrelloidinae -- the last being proposed to accommodate all those thelastomatids having their vulva anterior to the base of the oesophagus. The sub-family Aorurinae Walton, 1927, was made a synonym of Thelastominae. The remaining two sub-families of Travassos -- Oniscicolinae and Ransomnematinae -- were removed from the Thelastomatidae; Oniscicolinae was placed in the family Heterakidae. He removed the genus Cruznema from the Ransomnematinae and referred it provisionally to the Atractidae, suggesting that the sub-family Ransomnematinae might belong, with Oniscicolinae, to the Heterakidae; however, in 1937 Chitwood (24) placed it in the Atractidae.

Filipjev (41) completely changed the whole classification of this group. He suppressed the family Thelastomatidae, making the sub-families Thelastomatinae and Aorurinae synonyms of the sub-family Oxyurinae. He revived the sub-family Lepidoneminae Travassos and placed it, together with the genera Oniscicola and Cruznema, with Ransomnematinae in the family Kathlaniidae. He suppressed the family Rhigonematidae Artigas and its sub-family Icthyocephalinae, and placed the three genera contained in this family in the sub-family Rhigonematinae, which he placed in the

family Atractidae. He also proposed a new sub-family, Carnoyinae, to contain the genera Carnoya Gilson and Rondonema Artigas, which had been placed in the Ransomnematinae by Travassos (86).

The present writer agrees with Chitwood (20) and feels that the family Thelastomatidae forms a distinct natural group among the Oxyuroidea and should be retained. However, it is unfortunate that except for the number of head papillae there is no other character to separate this family from other groups of Oxyurids. He feels also that there is no necessity to retain the sub-families of Thelastomatidae. The sub-family Hystrignathinae lost its iedntity when species with and without spines were described in the same genus, and this was the only character by which the sub-family was distinguished. The sub-family Protrelloidinae was based only on the anterior position of the vulva, although in the thelastomatids, the vulva has moved, in various species, from its primitive place -- the middle of the body -- to near the anus on the one hand, and the head on the other.

FAMILY THELASTOMATIDAE TRAVASSOS, 1929.

Synonym: Lepidonemidae Travassos, 1929.

Family diagnosis :- Oxyuroidea: Mouth of female surrounded by eight submedian papillae or labiopapillae. Amphids represented externally by circular or oval openings; oesophagus consisting of an anterior corpus, which may or may not be modified; a more or less distinct isthmus and a posterior valvular bulb. Females with one or two ovaries. Male with single testis, a single spicule or none, and one to five pairs of caudal papillae.

Type genus: Thelastoma Leidy, 1849.

Key to the Genera of the Family Thelastomatidae.

1. Vulva posterior to base of oesophagus ---------- 2
   Vulva anterior to base of oesophagus ---------- 23

2. Oesophagus with a pseudobulb ---------- 3
   Oesophagus without a pseudobulb ---------- 7

3. Vulva in anterior part of body -- Hammerschmidtiella
   Vulva about middle or posterior to middle of body ------- 4

4. Anterior and posterior parts of corpus not distinctly set off, the whole corpus forming a pear-shaped pseudobulb ---------- Aorurus
   Anterior and posterior parts of corpus distinctly set off ---------- 5

5. Corpus distinctly enlarged in form of a subspherical swelling at base of buccal cavity Blattophila
   Corpus not distinctly enlarged in form of a subspherical swelling at base of buccal cavity ---------- 6

6. Corpus terminated by a sub-cylindrical swelling -------- Leidynema
   Corpus terminated by a sub-spherical swelling ---------- Leidynemella

7. Females with a single ovary ---------- 8
Females with two ovaries ---------- 11

8. Female buccal cavity extremely small and short, cervical region not provided with spines ---------- 9
Female buccal cavity considerably elongated, cervical region usually provided with spines ---------- *Artigasia*

9. Female tail long and filiform-- *Johnstonia*
Female tail short and not filiform ---------- 10

10. Female oesophagus long, forming about one-third of body length ---------- *Galebia*
Female oesophagus short, forming only about one-sixth or less of body length ---------- 11

11. Vulva in the middle third of body, tail of female attenuated ---------- *Blattellicola*
Vulva in the posterior third of body, tail of female conical ---------- *Blatticola*

12. Eggs bearing filamentous threads ---------- 13
Eggs without any filamentous threads ---------- 14

13. Eggs with two filaments arising from a knob-like lateral outgrowth and wound spirally round the egg-shell ---------- *Pseudonymous*
Eggs bearing tufts of polar filaments and laid in mucous capsules usually enclosing several eggs *Binema*

14. Female cervical region bearing backwardly-pointed spines ---------- *Hystrignathus*
Female cervical region not bearing backwardly-pointed spines ---------- 15

15. Female cervical region bearing long rows of backwardly-pointed "scales" ----- *Lepidonema*
Female cervical region without any cuticular scales 16

16. Vulva distinctly anterior, at about 25% of body length ---------- *Suifunema*
Vulva not distinctly anterior, at about the middle or posterior to middle of body ---------- 17

17. Eggs organically fused in pairs along their sides *Cameronia*.
Eggs not fused in pairs ---------- 18

18. Female tail filiform ---------- 19
Female tail not filiform ---------- 21

19. Tail of male very short ---------- Euryconema
Tail of male long and filiform ---------- 20

20. Excretory pore posterior to base of oesophagus, tail of female about one third or less of body length Schwenkiella
Excretory pore anterior to base of oesophagus, tail of female usually more than one-third of body length ---------- Thelastoma

21. Eggs bearing longitudinal grooves -- Severianoia
Eggs without any longitudinal grooves ---------- 22

22. Egg shell very thick, covered with thick and short spinous outgrowths all round and laid in a chain enclosed in a mucous tube --------- Gryllophila
Egg shell thin and without any spines, laid singly ---------- Cephalobellus

23. Tail of female short and conical ---------- 24
Tail of female long and filiform ------Linstowiella

24. Female oesophagus long and narrow, forming about one-fourth of body length; male tail digitiform ----- Protrelloides
Female oesophagus not as long or narrow; tail of male not digitiform ---------- 25

25. Mouth surrounded by eight prominent finger-like papillae ---------- Protrelleta
Mouth surrounded by eight labio-papillae, not digitiform ---------- Protrellus

GENUS THELASTOMA LEIDY, 1849

Synonym : Oxyuris Rud., 1803 (in part)

Generic diagnosis:— Thelastomatidae: Mouth of female surrounded by eight papillae or labiopapillae; amphids present. Buccal cavity simple, without any ornamentation. Oesophagus consisting of an anterior corpus, an isthmus and a posterior valvular bulb. Excretory pore anterior to base of oesophagus. Tail of female filiform, more than one-fourth of the body length. Vulva near middle of body; two ovaries; uteri divergent. Tail of male elongate, somewhat filiform, bearing four pairs of caudal papillae, one pair being preanal and ventral in position; in addition there is a postanal projection being paired sensory endings, and a pair of papillae on the tail some distance from the anus.

Type species : Thelastoma attenuatum Leidy, 1849

1. Thelastoma attenuatum Leidy, 1849 (Fig. 1, A-C)

Synonyms: Aorurus (Thelastoma) attenuatum Leidy, 1849.

Thelastomum attenuatum Leidy, 1853.

Anguillula (Thelastoma) attenuatus (Leidy, 1849) Diesing, 1861.

Aorurus (Thelastoma) attenuatus (Leidy, 1849) Walton, 1927.

Specific diagnosis:— Thelastoma :

Male : Not known.

Female: 2.54 to 3.18 mm. long by 267μ wide at middle. Cuticle transversely striated. Mouth opening surrounded by 8 labiopapillae; amphids present. Buccal cavity short and

cylindrical extending up to the first two-and-a-half annules. Oesophagus consisting of a cylindrical corpus, 529μ long by 47μ wide, an isthmus and a posterior valvular bulb; isthums plus bulb 142μ long by 114μ wide. Intestine dilated anteriorly to form a cardia. Anus 1.814 mm. from the posterior end of the body. Tail filiform, forming about 50% of the total body length. Excretory pore anterior to base of oesophagus. Nerve ring surrounds the anterior part of the corpus. Vulva a little anterior to middle of body including the tail. Two ovaries, amphidelphic. Eggs 76μ long by 63μ wide.

Host: Julus marginatus, Sporobolus marginatus, (Millepede).

Location: Large intestine, rarely small intestine.

Distribution: U.S.A.

2. Thelastoma spicatum Cobb, 1929 (Fig. 1, D).

Specific diagnosis:- Thelastoma:

Male: Not known.

Female: 2.8 mm. long by 263μ wide at middle of body. Cuticle coarsely striated. Mouth opening subtriangular, surrounded by eight labiopapillae; amphids present. Buccal cavity 14μ deep. Oesophagus 504μ long, consisting of a cylindrical corpus, an isthmus and a posterior valvular bulb. Anus 616μ from the posterior end of body. Tail spicate, filiform, occupying about one-fourth of the total length of the body. Nerve ring 224μ from the anterior end of body, situated at about the middle of the corpus. Excretory pore anterior to base of

oesophagus. Vulva a little anterior to middle of body including the tail. Two ovaries , amphidelphic.

Host: Sporobolus marginatus (Millepede).

Location: Intestine.

Distribution: U.S.A.

(Note: Figures calculated from Cobb's (35) formula).

3. Thelastoma pachyjuli (Parona, 1896) Travassos, 1929. (Fig. 1, E-G).

Synonyms: Oxyuris pachyjuli Parona, 1896.

O. bulhõesi Magalhães, 1900

Bulhõesia bulhõesi (Magalhães, 1900) Schwenk, 1926.

Aorurus (Thelastoma) bulhõesi (Magalhães, 1900) Walton, 1927.

Specific diagnosis:- Thelastoma:

Male: 1.1 mm. long by 35 to 40μ wide. Oesophagus 144μ long. Intestine simple; anus 84μ from the posterior end of body. Tail tapering, attenuated, not distinctly filiform. Caudal papillae consisting of one pair of large double ventral preanal papillae, one pair of subventral adanal papillae, a questionable structure immediately postanal, and a pair of sub-lateral papillae situated about one-fourth of the length of the tail from its origin. One spicule, 35μ long.

Female: 2.28 to 2.64 mm. long by 188 to 273μ wide. Mouth surrounded by eight submedian papillae; amphids present. Oesophagus 463 to 594μ long, consisting of a cylindrical corpus 329 to 280μ long by 38 to 40μ wide, an isthmus 34 to 36μ long by

22 to 30μ wide, and a posterior valvular bulb 86 to 106μ long by 80 to 95μ wide. Nerve ring situated about 230μ from the anterior end of body. Excretory pore anterior to oesophageal bulb about 430μ from the anterior end of body. Intestine enlarged anteriorly to form a cardia; anus 720 to 920μ from posterior end of body. Tail filiform, varying in proportionate length. Vulva 1.0 to 1.21 mm. from the anterior end of body; amphidelphic. Eggs nearly spherical, 70 to 80μ long by 50 to 72μ wide.

Host: Periplaneta americana Linn.
Location: Large intestine.
Distribution: North and South America.

Thelastoma bulhõesi very closely resembles T. spicatum in its general morphology, the only difference being that the head in the former does not show lobes like those of the latter and that it has 3 chitinous teeth projecting into the oral opening. Such structures are not shown by Cobb (35) in his diagram of the en face view of T. spicatum. The tail in T. bulhõesi is one-third of the body length while in T. spicatum it is less than one-third of the body length. Moreover, the former is a parasite of a cockroach while the latter is found in millepedes.

4. Thelastoma macramphidium (Christie, 1931) n.comb. (Fig. 1, H-P).

Synonyms: Thelastoma (Thelastoma) macramphidium Christie, 1931.

T. (T.) papilliferum Christie, 1931.

Specific diagnosis:- Thelastoma:

Male: Body moderately robust, 1 to 1.4μ long by 58 to 90μ wide at middle, coarsely annulated, annules 5 to 7μ apart. Narrow alae present, 4μ wide at middle of body. Head set off by a constriction. Mouth opening triangular, without distinct lips, but with eight indistinct papillae. Amphids conspicuous. Oesophagus consists of an anterior corpus which is slightly expanded in the middle with a diameter three-eights of the corresponding body diameter, an isthmus and a bulb, both a little longer than in the female. Excretory pore level with or posterior to the oesophageal bulb. Nerve ring slightly anterior to the isthmus. Intestine dilated anteriorly to form a cardia; anus located on a distinct elevation. Tail filiform, bearing a pair of preanal papillae, a pair of papillae opposite the anus, a median, postanal double papillae and a pair of postanal papillae about 80μ posterior to anus. Length of tail variable. One spicule, 40 to 55μ long with a diameter of 3.5 to 5μ in its thickest region; it is slightly expanded at its proximal end, and ends distally in a ball-like enlargement. Testis large and reflexed.

Female: Body moderately robust, 2.3 to 3.5 mm. long. Head region distinctly set off. First annule behind the head region, 13 to 16μ wide, succeeding annules 7 to 8μ apart, increasing to 12 or 13μ near base of oesophagus. Alae absent. Mouth opening subtriangular, bordered by three distinctly elevated lips, and surrounded by eight labio-papillae on the outer margin of the head. Amphids present. Buccal cavity 14 to 16μ deep by

11 to 13μ wide, having three feebly developed teeth. Oesophagus consisting of an anterior corpus having a more or less uniform diameter gradually increasing slightly posteriad, separated by a distinct isthmus, which is nearly the same width as the corpus just anterior to it, and a posterior valvular bulb. Intestine somewhat dilted anteriorly to form a rather slight cardia. Rectal glands present. Anus 1.1 mm. from the posterior end of body. Tail filiform, narrowing abruptly behind the anus, extending in the form of a narrow, sharp caudal spike. Excretory pore opposite the oesophageal bulb. Nerve ring slightly anterior to middle of oesophagus. Vulva near middle of body. Two ovaries, amphidelphic. Eggs ellipsoidal, 80μ long by 60μ wide, deposited before segmentation.

Host: Larva of Osmoderma (O. scabra Beauv.?)
Location: Posterior end of intestine.
Locality: Michigan, U.S.A.

T. macramphidium closely resembles T. attenuatum in its body structure. The only obvious difference between the two which could be detected by the present author is in the position of the excretory pore. In T. macramphidium it lies opposite to the oesophageal bulb while in T. attenuatum, it lies a little anterior to it.

Christie (3) wrote that T. macramphidium very closely resembled T. alatum Johnston, 1914, and that the only difference between the two was in the presence of alae on the tail of the male in the latter species, which were not observed by him in his species. He obviously overlooked the fact that Johnston's species has only one ovary while he has described two for his species.

5. Thelastoma riveroi Chitwood, 1932 (Fig. 1, Q-R).

Specific diagnosis :- Thelastoma:

Male: 850µ long by 70µ wide. Oesophagus 190µ long. Isthmus not distinct. Corpus 16µ wide and bulb 26µ wide. Anus 119µ from posterior end of body. Tail filiform, bearing a pair of subventral preanal papillae, a pair of sublateral postanal papillae, a pair of subventral papillae at the base of the truncated portion of the body, and a pair of subventral papillae 38µ posterior to the anus. One spicule, 38µ long.

Female: 2.4 to 2.7 mm. long by 171 to 230µ wide. Mouth opening surrounded by eight large labiopapillae; amphids present. Oesophagus 500 to 570µ long consisting of a corpus 400 to 430µ long by 30 to 36µ wide, isthmus 28 to 40µ long by 30 to 32µ wide distinctly set off both anteriorly and posteriorly, and a bulb 96 to 100 u long by 90 to 98 u wide. Nerve ring 200 to 250µ from the anterior end of body. Excretory pore at level of middle of oesophageal bulb, 440 to 530µ from the anterior end of body. Intestine enlarged anteriorly to form a slight cardia; anus 680 to 880µ from posterior extremity; tail filiform. Vulva in the middle of body, 1.17 to 1.36 mm. from the anterior end. Two ovaries, amphidelphic. Eggs sub-spherical or oval, 76 to 90µ long by 48 to 70µ wide; shell bearing a distinct thickened groove.

Host:	Periplaneta sp.
Location:	Large intestine.
Distribution:	Cuba, Havana.

This species closely resembles T. bulhoesi but differs from it in the presence of a groove on the egg shell, and in the position of the excretory pore which lies level with the middle of the oesophageal bulb and not anterior to it.

6. Thelastoma labiatum Leidy, 1850 (Fig. 1, S-U)

Synonyms: Aorurus (Thelastoma) labiatum Leidy, 1851

Thelastomum labiatum Leidy, 1856

Anguillula (Thelastoma) labiatum (Leidy, 1850) Diesing, 1861.

Aorurus (Thelastoma) labiatus (Leidy, 1850) Walton, 1927.

Thelastoma (thelastomellum) myolabiatum Cobb, 1929.

Specific diagnosis:- Thelastoma:

Male: Unknown.

Female : 1.058 to 1.6 mm. long by 127 to 185µ in maximum width. Cuticle coarsely striated. Mouth opening surrounded by eight well developed labiopapillae appearing like eight lobes; amphids present. Buccal cavity short. 14µ long. Oesophagus 320µ long consisting of a cylindrical corpus, an isthmus and a posterior valvular bulb. Corpus 212µ long by 25µ wide, isthmus plus bulb 110µ long and bulb 62µ wide. Intestine dilated anteriorly to form a cardia. Anus 528 to 635µ from the posterior end of the body. Tail filiform, occupying from one-third to one-half of the body

short and wide, containing one dorsal and two sub- ventral, anteriorly projecting cuticular structures shaped somewhat like palm leaves. Oesophagus 618 to 636μ long, consisting of a corpus 440 to 550μ long by 20μ wide, an isthmus 32μ long by 16μ wide, and a bulb 60μ long by 60μ wide. Nerve ring 220μ and excretory pore 450μ from the anterior end of body. Intestine enlarged anteriorly to form a distinct cardia. Anus 560 to 680μ from posterior end of body; tail filiform. Vulva 772μ to 1.0 mm. from the anterior end of body; vagina directed anteriorly; uteri divergent; anterior ovary directed posteriorly and reflexed anteriorly; posterior ovary directed anteriorly, reflexture not observed.

Host:	Panesthia javanica
Location:	Presumably intestine.
Distribution:	Philippine Islands.

This species may be distinguished from other species of the genus Thelastoma by the characteristic palm leaf-like cuticular projections in the buccal cavity, and a much longer oesophagus.

SPECIES INQUIRENDA.

Thelastoma depressum (Hammerschmidt, 1838) Leidy, 1853. (Fig. 2, A-C).

Synonyms: Oxyuris depressa Ham., 1838

O. dilatata Ham., 1847

O. laticollis Ham., 1847

Thelastoma dilatatum (Ham., 1847) Leidy, 1851.

T. laticolle (Ham., 1847) Leidy, 1851.

Aorurus (Thelastoma) laticollis (Ham., 1847)

Anguillula laticollis (Ham., 1847) Diesing, 1851.

Anguillula depressa (Ham., 1838) Diesing, 1851.

Thelastomum depressum (Ham., 1838) Leidy, 1853.

Anguillula (Thelastoma) depressa (Ham., 1838) Diesing, 1861.

A. (T.) laticolle (Ham., 1847) Diesing, 1861.

Specific diagnosis:- (?) Thelastoma:

Male: Unknown.

Female: Body very short, 530 to 791μ long by 66 to 85 μ wide. Cuticle striated. Oesophagus occupies between one-fourth and one-third of the body length. Oesophageal bulb large, spherical, occupying almost the whole body width. Anus 132 to 220μ from the posterior end of body. Tail filiform, occupying about one- fourth of the total body length. Vulva at about middle of body. Eggs 53μ long by 25μ wide.

Host: Larvae of Pachnotosia marmorata (= Cetonia marmorata) and Oxythyrea funesta (= Cetonia stictica)

Location: Intestine.

Distribution: Germany.

Oxyuris dilatata Ham., 1847, is obviously a synonym of O. depressa Ham., 1838 because Figures 26 and 27, Plate X, of Hammerschmidt's 1847 paper (48) are exact duplicates of Figures d and e, Plate IV of O. depressa, which appeared in his 1838 paper (47). Moreover, the descriptions in the two papers are the same for both species. It should, therefore, be assumed that O. dilatata is O. depressa, renamed and redescribed.

O. laticollis Ham., 1847, described from the larvae of Cetonia stictica also appears to be similar to O. depressa. Figures 29 and 31, Plate X, of O. laticollis (48) are similar to figures given for O. Depressa (47) in all aspects except that the former show the presence of reproductive organs and some tissue round the oesophagus. Hammerschmidt (48) separates the two species by stating that in O. laticollis the oesophagus is surrounded by a reticular tissue while in O. depressa no such tissue is present. Obviously he had only larval specimens of O. depressa and it is possible that in the larval stage such tissue might not have developed.

Another point worth mentioning is that a study of Hammerschmidt's diagrams of O.dilatata show that in Figures

29 and 31, the oesophagus is one-third of the body length while in Figure 33 of the same species, it is much shorter and occupies only one-fourth of the body length. In all other respects both are very similar. The specimen drawn in Figure 33 is longer and stouter and, therefore, apparently older than the one shown in the other figures. It is possible that as the worm grows in age, the size of the oesophagus in proportion to the length of the body is reduced. Another possibility is, that while passing through the fixation, dehydration, and clearing processes, the worm has shrunk; this really appears to be the case as shown by some of his diagrams, and this might account for the shortening of the oesophagus and the accumulation of the so-called reticular tissue around it. Such a condition can easily be seen in worms which have shrunk during fixation or other preparatory processes.

Key to the Species of the Genus Thelastoma.

1. With palm leaf-like cuticular projections in the buccal cavity ---------- T.palmatum
   Without pal leaf-like cuticular projections in the buccal cavity ---------- 2

2. Excretory pore opposite the oesophageal bulb -------- 3
   Excretory pore anterior to the oesophageal bulb ----- 4

3. Eggs with a distinct groove on the shell ----------
   T. riveroi
   Eggs without a groove on the shell ----------
   T. macramphidium

4. Tail forming about half of the total body length .--- 5
   Tail forming much less than half of the total body length ---------- 6

5. Labiopapillae not prominent -- T. attenuatum
   Labiopapillae very prominent, appearing as lip-like structures ---------- T. labiatum

6. Tail about one-third of the body length ----------
   T. pachyjuli
   Tail about one-fourth of the body length ----------
   T. spicatum.

DISCUSSION

In 1849 Leidy (51) proposed a new genus, Aorurus, and divided it into two subgenera to accommodate two species of nematodes from a millepede described by him as A. (Streptosoma) agile and A. (Thelastoma) attenuatum. In 1850 (52) he added to the subgenus Thelastoma three more species naming them A.(T.) appendiculatum, A. (T.) labiatum, and A.(T.) robustum. In 1851 (53), in a revision of his previous papers, he listed all the species which he thought could belong to the subgenus Thelastoma. In addition to the species previously described by him, and listed above, he added two more species which were described by Hammerschmidt in 1838 (47) and 1847 (48), that is, T. gracile (=Oxyuris gracillis Ham., 1838 and T. dilatatum (= O. dilatata Ham., 1847), including O.laticoll: Ham., 1847, as a synonym of the latter.

In 1853, Leidy (55) raised the subgenera Streptosoma and Thelastoma to full generic rank as Streptostomum and Thelastomum, and in his list of the species of the latter genus, redescribed all the species which he had described previously, without any changes, but revising his opinion about the species described by Hammerschmidt, now recognizing O. latticollis as vali He renamed them as: T. gracile (= O. gracillis Ham., 1838), T. depressum (= O. depressa Ham., 1838) with O. dilatata Ham. as a synonym, and T. laticolle (= O. laticollis Ham., 1

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1847

In 1856 (56) he added another species to this genus naming it T. venustum; this species was not from an invertebrate but a vertebrate host, namely, a turtle.

Diesing (36, 38) refers these species to the genus Anguillula and von Linstow (57) also lists them in the same genus.

In 1883, von Linstow (58) described a species from a cockroach under the name of O. lanceolata. Later he described a species from a millepede as O. glomeridis, and in 1886 he (60) redescribed the same species in greater detail under a different specific name, calling it O. ovocostata. In his discussion of O. ovocostata, he stated that the four oxyurids described by Hammerschmidt were placed incorrectly by Diesing in the genus Anguillula, and apparently returned them to the genus Oxyuris.

In 1896, Meyer (62) described a species from Julus as O. longicaudata, placing it very near to O.glomeridis. In the same year Parona (63) described a number of new species from millepedes placing four into the genus Oxyuris. These were : O. pachyjuli, O. sphaeropoei, O. platyrhaci, O.sumatrensis

In 1900, Magalhães (61) described an Oxyurid from a cockroach and called it O. bulhõesi.

In 1914, Johnston (50) again recognized the genus Thelastomum and described a species from a beetle larva as T. alatum.

In 1916, Skrjabin (73) described two species from

Polydesmus sp., naming them O. myriapodicola (which he thought was very similar to O. longicaudata Mayer) and O. leidyi. The same author (74) in 1923 described two more species from a myriapod, T. caucasicum and T. crimense. On this occasion, however, because he had a male specimen he revised his previous opinion and wrote that :

> " this circumstance has put me right in not putting these parasites in the genus Oxyuris Rud. (sensulato), but directly in the special genus Thelastomum Leidy, 1849."

He also revised the genus Thelastomum and gave a list of ten species which he thought should be included in it. These were: T. caucasicum, T. labiatum, T. myriapodicola, T.crimense T. pachyjuli, T.platyrhaci, T. attenuatum, T. appendiculatum, T. longicaudatum, and T. bulhõesi.

In 1923, Sergiev (71) described two nematodes from Gryllotalpa, one of which he placed in the genus Thelastomum, calling it T. skrjabini; the other he placed in the genus Oxyuris and named it O. korsakowi. Obviously, the latter does not belong to the genus Thelastomum.

In 1926, Schwenk (70) proposed two new genera, Blatticola and Bulhõesia, the former to accommodate Oxyuris blatticola Galeb, and the latter for three new species which he called B. magalhãesi, B. icemi, and B. severianoi, all from the wild roach, "Barata selvagem."

In 1927, Walton (89) restudied the collection of Leidy and also had available some fresh material from almost the same hosts. He proposed to revive the genue Aorurus

Leidy, with its original subgenera Thelastoma and Streptostoma. He gave a revised diagnosis of both these subgenera as well as a list of the species to be included in each. In the subgenus Streptostoma he placed A. (S.) diesingi, A.(S.) blattae-orientalis, A. (S.) künckeli, A. (S.) longicaudatus, A.(S.) pachyjuli, and A.(S.) leidyi. In the subgenus Thelastoma he placed A.(T.) attenuatus, A.(S.) appendiculatus, A.(T.) labiatus, A.(T.) robustus, A.(T.) brevicaudatus, A.(T.) gracilis, A.(T.) laticollis, A.(T.) depressus, A.(T.) blatticola, A.(T.) bulhõesi, A.(T.) alatus, and A.(T.) myriapodicolis. Walton also proposed a new genus Thelastomoides to accommodate T. venustum Leidy, 1856, which was described from a turtle and not from an invertebrate host.

In 1929, Travassos (86) in his synopsis of nematodes of arthropods gave a list of all the species which he felt could be referred to the genus Thelastoma. He made the genus Bulhõesia Schwenk, 1926, a synonym of Thelastoma and placed two of its species, B. magalhãesi and B. icemi under Thelastoma while for the third, B. severianoi, he proposed a new genus, which he called Severianoia. He transferred O. gracile Ham., 1838, to the genus Aorurus.

In 1929, Cobb (35) again divided the genus Thelastoma into two subgenera and described two new species from a millepede, calling them T. (Thelastoma) spicatum and T.(Thelastomellum) myolabiatum.

In 1929, Artigas (3) also listed the species of the genus Thelastoma; this list is the same as that given by Travassos (86).

In 1931, Christie (27) added two new species to this genus, T.(Thelastoma) macramphidium and T.(T.) papilliferum. In 1938, he (30) made the latter a synonym of the former, and also remarked that in his opinion T. (T.) myolabiatum Cobb, was a synonym of T. labiatum. The same author (28) proposed that T. brevicaudatum, O. leuckarti, and O. brachyura be transferred from the genus Thelastoma to the genus Cephalobellus Cobb, 1920.

In 1932, Chitwood (20) made a more exhaustive study of these nematodes but his study was confined to those parasitic in the family Blattidae. Here he described one new species of the genus Thelastoma, T. riveroi. He divided the species of this genus into three groups namely sensu restricto, sensu lato, and species inquirenda. In the first group he placed T. bulhõesi, T. riveroi, and T. attenuatum; in the second group he placed T. icemi and T. panesthiae. He transferred T. appendiculatum (=O. blattae-orientalis Ham) to the genus Leidynema Schwenk, 1929. In 1933, Chitwood and Chitwood (21) added another species to the genus Thelastoma, calling it T. palmatum. They also proposed a new genus, Leidynemella and placed T. panesthiae (= O. panesthiae Galeb, 1878) in it; this species had been regarded by Chitwood(as a species inquirenda in the genus Thelastoma.

In 1938, Christie (30) redescribed what he believed was T. robustum Leidy.

In 1940, Basir (5) described two new species from cockroaches and assigned them to this genus calling them T. indiana and T. aligarhica. In 1947, however, he (12) made T. indiana a synonym of Cephalobellus brevicaudatum (Leidy, 1851

In 1943, Todd (80) described a worm which he believed to be T. icemi.

The present author feels that the genus Thelastoma forms a heterogeneous group, most of the worms from arthropods being simply placed in it or the genus Oxyuris by older workers, A few, like Leidy (55), Skrjabin (74), Walton (89), Travassos (86), Christie (27) and Chitwood(20) tried to give a definite form to this genus. Actually, it was never thoroughly revised, although Chitwood (20) suggested that :

> "the genus Thelastoma contains at present a large number of species many of which may eventually be found to belong to other genera"

and Christie (27) wrote that :

> "At present the genus Thelastoma is in a very confused condition. It contains a considerable number of species, many of which have been inadequately studied and described, and some of which obviously do not belong to the genus. Until the whole group has been carefully worked over, it is impossible to key the genus or provide any given species with a specific diagnosis that will positively differentiate it from all other species of the genus."

Even at present, the genus Thelastoma includes worms with long filiform tails, with short tails, with the excretory pore anterior to the base of the oesophagus or

posterior to it, with one or with two ovaries.

Of the 44 species placed in this genus many have been removed to other genera by various authors and for some, new genera have been assigned as follows :-

To the genus Cephalobellus:

O. leuckarti, T. indiana,
O. brachyura, B. magalhaesi.
T. brevicaudatum,

To the genus Sevirianoia:

O.gracilis. O. ovocostata.
O.glomeridis,

To the genus Thelastomoides:

T. venustum.

To the genus Leidynemella:

O. socialis, O. panesthiae.

To the genus Protrellus:

O. lanceolata.

To the genus Gryllophila:

T. skrjabini.

To the genus Desmicola n. g.:

O. leidyi.

To the genus Blatticola:

O. blatticola:

To the genus Hammerschmidtiella:

O. diesingi.

To the genus Leidynema:

T. appendiculatum.

To the genus Schwenkiella n. g.:

B. ichemi,
T. aligarhica,
T. robustum,
O. longicaudata.

To the genus Johnstonia n.g. :

O. sphaeropoei,
O. myriapodicola,
T. alatum,
T. crimense.

This accounts for 27 species. Of the remaining 17, the present author has referred 13 to the genus Thelastoma; of these 13, three are referred to as species inquirenda. The 13 species referred to the genus Thelastoma are:

T. attenuatum,
T. labiatum,
O. pachyjuli,
O. bulhõesi,
T. (T.) spicatum,
T. (Thelastmellum) myolabiatum,
T. (Thelastoma) macramphadium,
T. (Thelastoma) papilliforum,
T. riveroi,
T. palmatum,
O. depressa,
O. dilatata,
O. laticollis.

There remain four species which, due to lack of proper characterization, could not be assigned to any genus and consequently have been kept as species inquirenda in the

family Thelastomatidae. These are:

O. gryllotalpae,

O. platyrhaci,

O. heterogaminae,

O. sumatrensis.

LEGENDS.

Figure 1.

(A-C) Thelastoma attenuatum

A. Female, anterior region.
B. Female, reproductive organs.
C. Larva.

(D) T. spicatum.

D. Female, en face view.

(E-G) T. pachyjuli

E. Female, en face view.
F. Female, anterior end.
G. Male tail, lateral view.

(H-P) T. macramphidium

H. Female, anterior region.
I. Female, head end magnified.
J. Female, en face view.
K. Female, region of vagina.
L. Female, tail.
M. Male, en face view.
N. Male, anterior region.
O. Male, tail lateral view.
P. Male tail, ventral view.

(Q-R) T. riveroi

Q. Female, anterior region.
R. Male tail, lateral view.

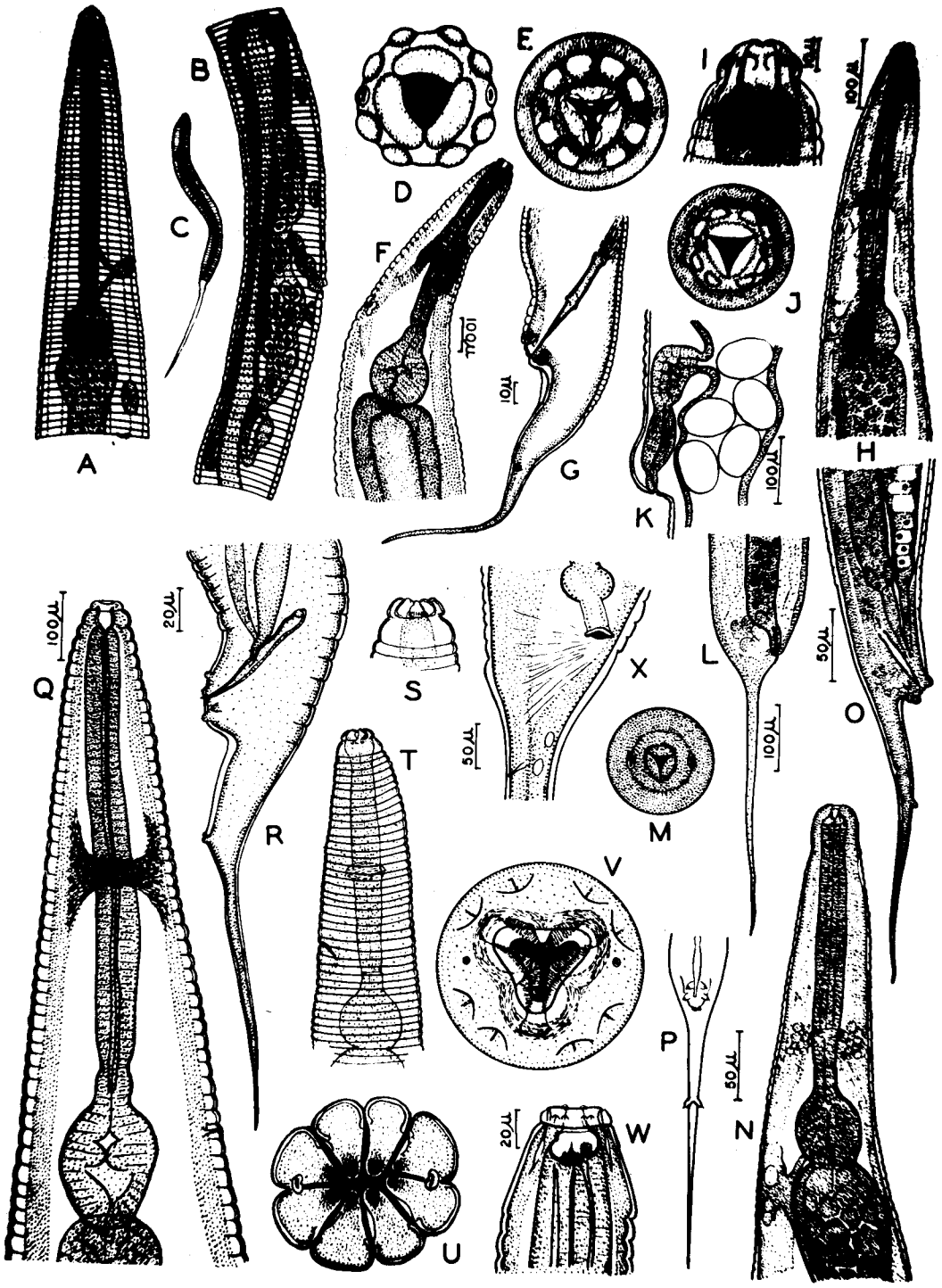
(S-U) T.labiatum.

S. Female, head end, magnified.
T. Female, oesophageal region.
U. Female, en face view.

(V-X) T. palmatum

V. Female, en face view
W. Female, head end, magnified.
X. Female, anal region.

(A-C after Leidy, (55); D, S-U after Cobb (35), E-G, Q-R after Chitwood (2), H-P after Christie (27), and V-X after Chitwood (21).)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GENUS SCHWENKIELLA GEN. NOV.

Synonym: Bulhöesia Schwenk, 1926 (in part)

Generic diagnosis:- Thelastomatidae: Female with mouth opening surrounded by eight labiopapillae. Buccal cavity short and may or may not be armed with three tooth- like projections. Oesophagus short, about one-sixth to one-eighth of body length, consisting of a more or less cylindrical corpus, a short isthmus and a valvular bulb. Tail attenuated filiform. Excretory pore posterior to base of oesophagus. Vulva at about middle of body. Ovaries two; uteri divergent. Eggs oval to ellipsoidal. Male with a slender tail, single testis; single spicule; caudal papillae four pairs, three pairs preanal and one pair postanal.

Type species : Schwenkiella robustum (leidy, 1850) n. comb.

1. Schwenkiella robustum (Leidy, 1850) n. comb. (Fig. 2, K-N)

Synonyms: Aorurus (Thelastoma) robustum Leidy, 1850

Thelastomum robustum Leidy, 1853

Anguillula (Thelastoma) robusta (Leidy, 1850) Diesing, 1861.

Aorurus (Thelastoma) robustus (Leidy, 1850) Walton, 1927.

Thelastoma robustum (Leidy, 1850) Travassos, 1929.

Specific diagnosis :- Schwenkiella:

Male: 1.3 mm. long by 85μ wide. Body distinctly annulated throughout its length; annules about 5μ wide near head, gradually increasing in width to 10 to 20μ at middle of body. Alae conspicuous, extending from region of oesophageal bulb to opposite porximal end of spicule. Oesophagus about 160μ long consisting of an almost cylindrical corpus about 110μ long by 14μ wide, an isthmus about 19μ long by 12μ wide, and a posterior valvular bulb about 30μ wide. Intestine moderately dilated anteriorly. Nerve ring about 75μ and excretory pore about 200μ from anterior end of body. Testis single, wide and reflexed anteriorly. Spicule single, slightly curved, bearing an enlargement on the ventral side, with its distal end pointed, 32 to 40μ long. Anus 130μ from the posterior end. Tail moderately slender. In preserved specimens the anus is situated on a rounded elevation that bears three pairs of papillae, one pair slightly preanal, one pair slightly postanal , and a fused pair, ventro-median and slightly postanal; a fourth pair of papilla occurring about 50μ behind the anus.

Female : 3.9 to 4.4 mm. long by 700 to 800μ wide. Cuticle striated almost throughout the length of body ; striae 8μ apart near head to 20μ apart near the middle of body. First annule 19μ wide. Mouth opening surrounded by eight lobe-like labiopapillae. Amphids present. Buccal cavity short, 10μ deep by 8μ wide, armed at base

with three more or less tooth-like projections. Oesophagus about 460 μ long consisting of an almost cylindrical corpus about 340μ long by 40 μ wide, an isthmus about 30 μ long by 30μ wide and a posterior valvular bulb about 100 μ wide. Intestine dilated anteriorly to form a pronounced cardia which almost fills the body space. Nerve ring about 250 μ and excretory pore about 500 μ from the anterior end of body. Anus 1.1 to 1.25 mm. from the posterior end. Tail slender, filiform, about one-third of the body length. Vulva at about the middle of body. Vagina directed anteriorly, about 300 μ long. Ovaries two, one ovary arising anteriorly and the other posteriorly, anterior flexture always remaining far behind the base of oesophagus; posterior flexture may even extend posterior to the anus. Uteri amphidelphic. Eggs ellipsoidal, 75μ long by 50 μ wide, not segmented at time of deposition.

Host: larva of Osmoderma scabra Beauv., and of Xyloryctes satyrus Fab.

Location: Posterior end of alimentary tract.

Distribution: United States of America.

2. Schwenkiella icemi (Schwenk, 1926) n. comb. (Fig. 2, E-I)

Synonyms: Bulhöesia icemi Schwenk, 1926.

Thelastoma aligarhica Basir, 1940.

Specific diagnosis:- Schwenkiella:

Male: 1.1 mm. long by 0.07 mm. wide. Oesophagus 160µ long, consisting of an anterior corpus, 130µ long by 24µ wide at nerve ring, an indistinct isthmus, and a valvular bulb, 33µ long by 34µ wide. Nerve ring 100µ from the anterior end. Excretory pore posterior to base of oesophagus, 200µ from the anterior end of body. Anus 180µ from the posterior extremity. Tail filiform bearing three pairs of papillae, one pair ventral preanal, one pair sub-lateral post-anal, the last pair being 29µ posterior to anus. One spicule, 30µ long.

Female: 2.0 to 3.3 mm. long by 200 to 300µ wide. Cuticle striated throughout the length of body, more distinctly in the anterior region; striae 8µ apart anteriorly and up to 15µ apart at about the middle of body. Oral opening surrounded by eight well developed labiopapillae. Amphids present. Buccal cavity 12 to 15µ deep by 10µ wide. Oesophagus short, 360 to 460µ long, consisting of an anterior cylindrical corpus, 260 to 340µ long by 30 to 37µ wide, an isthmus 21 to 34µ long by 30 to 42µ wide and a bulb 77 to 105µ long by 80 to 100µ wide. Intestine enlarged anteriorly to form a pronounced cardia which almost fills the whole body width. Nerve ring 160 to 210µ from the anterior end. Excretory pore posterior to base of oesophagus, 380 to 580µ from the anterior extremity. Anus 360 to 650 u from the posterior end. Tail filiform. Vulva at about middle of

body, 1.22 to 1.58 mm. from the anterior end. Vagina directed anteriorly; uteri amphidelphic. Two ovaries, one arising anteriorly and the other posteriorly; both reflexed, the anterior flexture always remaining far behind the base of the oesophagus. Eggs ellipsoidal, 65 to 75μ long by 46 to 57μ wide.

Host: " Barata selvagem" (= wild roach), Periplan americana, P. brunneau.

Location: Intestine.

Distribution: São Paulo (Brazil), N. India, United States of America.

SPECIES INQUIRENDA.

Schwenkiella longicaudata (Meyer, 1896) n. comb. (Fig. 2, O-Q).

Synonyms: Oxyuris longicaudata Meyer, 1896.

Thelastomum longicaudatum (Meyer, 1896), Skrjabin, 1923.

Thelastoma longicaudata (Meyer, 1896), Travassos, 1929.

Aorurus (Streptostoma) longicaudata (Meyer, 1896), Walton, 1927.

Specific diagnosis:- (?) Schwenkiella:

Male: Unknown.

Female: 5.5 to 6 mm. long by 500µ in maximum width. Cuticle striated, annulations increasing in size posteriorly. Buccal cavity funnel-shaped. Oesophagus occupying about one-seventh of body length and consisting of a corpus, an isthmus and a valvular bulb. Intestine without a pronounced cardiac enlargement at its anterior end. Anus 1.0 mm. from posterior end of body. Tail attenuated filiform, suddenly narrowing behind the anus and appearing more or less like a spike, forming slightly less than one-fifth of the body length. Vulva exactly in the middle of body. Vagina short and directed anteriorly, meeting the two uteri which run forwards. Two ovaries, the anterior one reaching near the base of the oesophagus and the posterior one reaching the region of the hind gut. Eggs oval, 67.5µ long by 38µ wide.

Host: Julus sp.

Location: Presumably intestine.

Distribution: Ceylon.

The head end of this worm as drawn by Meyer (62) in his diagrams 23 and 24 resembles that of the genus Severianoia but the tail is rather long for that genus. Moreover, the eggs do not bear the longitudinal lines or at least there is no mention of these in the original description. This worm cannot be placed in the genus Cephalobellus because of the length of its tail, which in the latter is always conincal. The only genera to which it could be referred are Thelastoma and Schwenkiella, although the position of the excretory pore being unknown, it could not be placed with any certaintly in either. However, the tail resembles more closely those species belonging to the genus Schwenkiella than those of the genus Thelastoma. Its correct position will be ascertained only when material from the same host is restudied and the form of the eggs and the position of the excretory pore studied properly.

Key to the species of the genus Schwenkiella

Female tail forming more than one-third of body length -------- S. robustum.

Female tail comparatively shorter, forming much less than one third of body length --- S. icemi.

DISCUSSION.

Schwenkiella robustum (= Aorurus (Thelastoma) robustum Leidy, 1850) was first described by Leidy (52) in 1850 from the intestine of a "lamellicorn insect" and was placed by him in the subgenus Thelastoma of the genus Aorurus. Later he raised this subgenus to full generic rank. Leidy's description was not accompanied by any figures. This worm had not apparently been described by any other author until Christie (30) redescribed it in detail giving adequate diagrams. His description brings it very close to Thelastoma icemi (Schwenk, 1926) Travassos, 1929 (= Bulhõesia icemi Schwenk, 1926) from which it differs only in the size of its tail. Basir (6) described Thelastoma oligarhica from a cockroach in India; this species appears to be a synonym of T. icemi. Todd (80) redescribed T. icemi and also described the male. Although the original diagram of an entire female as given by Schwenk (70) shows a tail more attenuated than filiform, the actual measurements which he gives will bring the proportions to those given by Basir (6) or Todd (80).

Chitwood (20) felt that T. icemi and T. magalhãesi did not belong to the genus Thelastoma (sensu restricto) and remarked that these species might eventually be found to belong to other genera when information is obtained as to the character of the males. He also pointed out that the

excretory pore in species of Thelastoma (sensu restricto) lies anterior to the base of the oesophagus while in T. icemi and T. magalhães̃i it lies posterior to it and that the tails in the latter two species are attenuated rather than filiform. Todd (80) was of the opinion that the male of T. icemi described by him closely resembled the males of T. bulhões̃i and T. riveroi which have been listed by Chitwood (20) as valid species, and that the difference in the position of the excretory pore appeared to him to have no more than specific value.

In the present work the writer has amended the generic diagnosis of Thelastoma and has limited it to include only species which have their excretory pore anterior to the base of the oesophagus and have long filiform tails. The creation of the genera Cephalobellus Cobb, 1920 and Severianoia Chitwood, 1932 removed from the genus Thelastoma all the species with short conical tails all of which had the excretory pore behind the base of the oesophagus. There still remained in it species with differences in the number of ovaries and in the position of the excretory pore. The present author feels that the creation of the genus Schwenkiella for those with filiform tails and with the excretory pore posterior to the base of the oesophagus and the creation of another genus for forms with a single ovary will help in the formation of definite groups and make systematics more simple and compact. It would appear to be difficult to form tight compartments to

contain all the worms referred to the genus Thelastoma at one time or another, because all gradations occur in the position of the excretory pore and the size of the tail. The creation of genera for such groups appears to be unnatural although we are left with no option but to take recourse to it for convenience of study.

GENUS JOHNSTONIA GEN. NOV.

Synonyms: Oxyuris Rud., 1803 (in part).
Thelastomum Leidy, 1851 (in part).
Aorurus Leidy, 1849 (in part).

Generic diagnosis:- Thelastomatidae: Female with short, simple, almost cylindrical buccal cavity. Oesophagus about one-sixth of the body length, consisting of a corpus, an isthmus and a valvular bulb. Intestine dilated anteriorly to form a distinct cardia. Excretory pore anterior to base of oesophagus. Tail filiform, spicate or thread- like. Vulva at about middle of body. One ovary. Eggs oval or ellipsoidal. Male with a slender tail, bearing near its base prominent lobe-like lateral alae; one club-shaped spicule; caudal papillae one pair (?) near anus.

Type species: Johnstonia alatum (Johnston, 1914) n.comb.

1. Johnstonia alatum (Johnston, 1914) n. comb. (Fig.2, R-T).

Synonyms: Thelastomum alatum Johnston, 1914.
Aorurus (Thelastoma) alatus (Johnston, 1914) Walton, 1927.

Specific diagnosis:- Johnstonia:

Male: 0.97 to 1.17 mm. long by 90µ in maximum width. Oesophagus consisting of a corpus, a distinct isthmus and a bulb. Nerve ring at about the middle of oesophagus, about 90µ from anterior end of body. Excretory pore opposite the

oesophageal bulb, 170μ from anterior extremity. Anus 60μ from posterior end of body appearing (in a fixed specimen) to be placed on a projection. The body narrows suddenly behind the anus, terminating in a point and forming a filiform tail, the anterior half of which is much broader than its posterior half. Each side of the hind end of body bears a prominent ala, which is somewhat arched and expanded in the anal region forming a thin lobe-like structure lying above the anus. Testis relatively large. One spicule, club-shaped, slightly curved, 45μ long. Caudal papillae one pair (?) in neighbourhood of anus.

Female: Body almost cylindrical, narrowing anteriorly in front of the base of oesophagus and posteriorly behind the anal region, 2.9 mm. long by 200μ in maximum width. Buccal cavity simple, cylindrical. Oesophagus 500μ long, consisting of a corpus, a narrow isthmus and a bulb having a diameter of 99μ. Intestine dilated anteriorly to form a distinct cardia which almost fills the whole body width. Nerve ring 200μ from anterior end of body. Excretory pore anterior to base of oesophagus, almost opposite the oesophageal bulb, 400μ from the anterior extremity. Anus 900μ from the posterior end of body; tail filiform, forming about one-third of body length. Vulva at about middle of body, slightly anterior to it, salient, situated on a relatively large backwardly projecting prominence, about 1.4 mm. from the anterior end.

One ovary, arising in the posterior region of body. Reproductive organs forming four loops. Eggs 80μ long by 50μ wide.

Host: Larva of a cetonid beetle (Cacachroa decorticata Mach.)

Location: Intestine.

Distribution: North Queensland, Australia.

2. Johnstonia myriapodicola (Skrjabin, 1916) n.comb. (Fig. 2,V).

Synonyms: Oxyuris myriapodicola Skrjabin, 1916.

Thelastomum myriapodicola Skrjabin, 1923.

Aorurus (Thelastoma) myriapodicolus (Skrjabin, 1916), Walton, 1927.

Specific diagnosis :- Johnstonia:

Male: Unknown.

Female: Body almost cylindrical in the middle, narrowing anteriorly in the oesophageal region and posteriorly in the region of the tail, 2.48 mm. long by 187μ in maximum width. Cuticle striated. Buccal cavity cylindrical with a slightly expanded posterior portion, extending to half of the second annule. Oesophagus 442μ long; corpus 34μ wide and bulb 68μ long by 85μ wide. Intestine enlarged anteriorly to form a distinct cardia which almost occupies the whole body width. Anus 500μ from the posterior extremity, the tail forming one-fifth of the body length, spicate filiform. Excretory

pore at level of the anterior part of the oesophageal bulb. Vulva at about the middle of body, 1.25 mm. from the anterior end; vagina directed anteriad. One ovary. Eggs 60 to 68 µ long by 45 µ wide.

Host: Polydesmus sp. (Myriapoda)

Location: Intestine.

Distribution: East Africa.

Skrjabin (73) compared this species with Thelastoma labiatum (Which is from the same host), Oxyuris pachyjuli, and O.longicaudata, and suggested that:

> "It is, however, beyond doubt that the future investigator will have to unite the species O.longicaudata Meyer, 1896, Thelastomum labiatum Leidy, 1850, Oxyuris myriapodicola, and probably O.pachyjuli into one common genus."

From his description and diagram it is clear that his species has only one ovary while all the three species mentioned by him have two ovaries. Therefore, the question of placing this worm with any of them does not arise. However, this species is very similar to J.alatum, but can be distinguished from it by its comparatively short tail.

3, Johnstonia crimense (Skrjabin, 1923) n. comb. (Fig.2,U)

Synonym: Thelastomum crimense Skrjabin, 1923.

Specific diagnosis:- Johnstonia.

Male: Unknown.

Female: 3.9 mm. long by 340μ in maximum width at about the middle of body. Cuticle striated, striae 13μ apart in the anterior region of body. Oesophagus 630μ long; bulb with a diameter of 136μ. Nerve ring at about the middle of oesophagus. Excretory pore anterior to base of oesophagus, slightly anterior to bulb, 390μ from anterior end of body. Anus 1.1. mm. from posterior extremity; tail filiform, 1.7 mm. from anterior end of body. One ovary. Eggs oval, 113μ long by 85μ wide.

Host: Julus sp.

Location: Intestine.

Distribution: Caucasians, Crimea, U.S.S.R.

J. crimense closely resembles the type species of the genus but differs from it in having larger eggs and a more anterior excretory pore. It differs from J. myriapodicola in possessing a much longer tail and a more anterior excretory pore.

4. Johnstonia sphaeropoei (Parona, 1896) n. comb.(Fig.2, W)

Synonym: Oxyuris sphaeropoei Parona, 1896

Specific diagnosis:- Johnstonia:

Male: Unknown.

Female: 4 mm. long by 500μ in width. Body striated

throughout its whole length. Oesophagus 750μ long; corpus enlarged posteriorly in the form of a sub-spherical pseudobulb, the latter having a width of 140μ; main bulb 336μ long by 434μ wide (?). Intestine straight. Tail spicate, filiform, forming about one-third of the body length. One ovary, starting in the posterior region of body; vagina directed anteriorly. Vulva slightly anterior to middle of body, about 1 mm. anterior to anus. Eggs oval, 420μ long by 280μ wide (?).

Host: Sphaeropoeus hercules (millepede).
Location: Intestine.
Distribution: Sumatra, Indonesia.

This species is characterized by having a distinct sub-spherical swelling of the posterior end of corpus in the form of a pseudobulb, a modification which is not seen in any other species of this genus. In all other respects it agrees with the general characters of the genus. The presence of a pseudobulb has been regarded as a generic character in the subfamily Thelastomatidae, but the description given by Parona (63) and his diagrams are so doubtful that it does not seem advisable to propose a new genus for this species. For the present it is being placed provisionally in the genus Johnstonia until fresh material from the same host can be studied.

Key to the species of the genus Johnstonia.

1. Tail comparatively short, about one-sixth of the body length ---------- J. myriapodicola.
   Tail longer, about one- third of body length -------- 2

2. Corpus with a posterior subspherical pseudobulb------ J.sphaeropoei.
   Corpus without a posterior pseudobulb ---------- 3

3. Excretory pore anterior to oesophageal bulb; eggs comparatively larger, 113 μ long by 85 μ wide ------ J. crimense.

   Excretory pore in the region of oesophageal bulb; eggs smaller, 80 μ long by 50 μ wide ---------- J. alatum.

DISCUSSION

All the species at present included in this new genus, for which the name Johnstonia has been proposed, were at one time or another palced either in the genus Oxyuris or in Thelastoma. Obviously they do not belong to the former genus and they have now been separated from the genue Thelastoma on the ground that while the latter genus is didelphic, all these species have only one ovary, although in other respects they closely resemble some species of that genus. The author regards this difference sufficient to create a new genus.

GENUS BLATTELLICOLA BASIR, 1940.

Generic diagnosis:- Thelastomatidae: Female with a simple cylindrical buccal cavity, a short oesophagus, about one-sixth of the body length, consisting of a corpus, an isthmus and a bulb. Tail short, attenuated, definitely not filiform. Excretory pore posterior to base of oesophagus. Vulva between middle and posterior third of body; ovary single. Eggs oval or ellipsoidal. Male with a short attenuated tail, not filiform; caudal papillae four pairs; two pairs preanal and two pairs postanal near the anal opening.

Type species: Blattellicola blattellicola Basir, 1940.

1. Blattellicola blattellicola Basir, 1940 (Fig. 2, X-Y)

Specific diagnosis:- Blattellicola:

Male: Unknown.

Female: 1.75 to 2.15 mm. long. The following measurements are taken from a worm 1.85 mm. long by 225 μ in maximum width. Cuticle conspicuously striated. First annule behind the head 18 μ long; remaining annules about 8 μ apart. Buccal cavity simple, short, cylindrical, 15 μ deep by 30 μ wide. Oesophagus 300 μ long, consisting of a cylindrical corpus 220 μ long by 30 μ wide, a short isthmus 10 μ long by 25 μ wide, and a bulb 70 μ long by 75 μ wide. Intestine dilated anteriorly to form a slight cardia which is only a little greater in

width than the preceding oesophageal bulb. Nerve ring 130μ and excretory pore 380μ from the anterior end of body. Anus 200μ from posterior end of body. Tail short, conically attenuated, not filiform. Vulva slightly anterior to posterior third of body, 1.2 mm. from the anterior end; one ovary. Eggs 76 to 60μ long by 35 to 40μ wide.

Host: Blattella germanica Linn.

Location: Intestine.

Distribution: Northern India.

2. Blattellicola caucasicum (Skrjabin, 1923) n. comb. (Fig. 2, Z-CC).

Synonym: Thelastomum caucasicum Skrjabin, 1923

Specific diagnosis:- Blattellicola:

Male: 0.68 mm. long by 68μ in maximum width. Cuticle striated throughout the length of body, striae about 6μ apart. Oesophagus 170μ long; bulb with a diameter of 34μ. Nerve ring at about the middle of the oesophagus. Excretory pore much posterior to base of oesophagus, 272μ from anterior end of body. Anus 65μ from posterior end; tail attenuated, not filiform. One spicule, 26μ long; four pairs of caudal papillae, two pairs preanal and two pairs postanal, near the anal opening.

Female : Body 3.1 mm. long, striated throughout its whole length. Buccal cavity short and cylindrical. Oesophagus

460 μ long, forming about one-seventh of the total length of body; corpus 20 μ wide having a diameter of 55 μ. Intestine dilated anteriorly to form a cardia, slightly broader than the oesophageal bulb. Nerve ring at about the middle of oesophagus. Excretory pore posterior to base of oesophagus, 630 μ from the anterior end of body. Anus 340 μ from the posterior extremity; tail conically attenuated. Vulva slightly posterior to middle of body, 1.6 mm. from the anterior end; one ovary. Anteriorly, genital ducts remain posterior to the excretory pore. Eggs oval, 100 μ long by 50 μ wide.

Host: Glomeris sp. (Millepede).

Location: Intestine.

Distribution: Caucasians, U.S.S.R.

Key to the species of the genus Blattellicola

Vulva about 65% of the body length from the anterior end, eggs 76 to 80 μ long by 35 to 40 μ wide ---------- B. blattellicola.

Vulva at about the middle of body, eggs comparatively larger, 100 μ long by 50 μ wide ---------- B. caucasicum.

DISCUSSION.

The original diagnosis of the genus Blattellicola was based on a single, not well preserved specimen. The present amendment of the generic characters is based on the study of fresh material. Sergiev (71) had described two species from a millepede, Thelastomum caucasicum and T. crimense. Both these species had to be removed from the genus Thelastoma in the present work because they have only a single ovary while members of the genus Thelastoma have two. T. caucasicum obviously belongs to the genus Blattellicola as it agrees with it in all essential aspects; T.crimense obviously does not belong here because of the difference in the shape and form of its tail and the position of its excretory pore.

LEGENDS.

Figure 2.

(A) *Oxyuris dilatata*

A. Female, entire.

(B-D) *O. laticollis*.

B. Female, entire.

C. Female. entire.

D. Egg.

(E-J) *Schwenkiella icemi*.

E. Female, entire.
F. Female, *en face* view.
G. Female, head end, magnified.
H. Male, entire,
I. Male, tail, lateral view.
J. Egg.

(K-N) *S. robustum*

K. Female, entire.
L. Female, *en face* view.
M. Female, head end, magnified.
N. Male, entire.

(O-Q) *S. longicaudata*

O. Female, oesophageal region.
P. Female, head end, magnified.
Q. Female, tail.

(R-T) *Johnstonia alatum*

R. Female, entire.
S. Male, entire.
T. Male, tail, lateral view.

(U) *J. crimense*

U. Female, entire.

(V) *J. myriapodicola*

V. Female, entire.

(W) J. sphaeropoei.

W. Female, entire.

(X-Y) Blattellicola blattellicola

X. Female, entire.
Y. Female, head end, magnified.

(Z-CC) Blattellicola caucasicum

Z. Female, entire.
AA. Female, head end, magnified.
BB. Male, entire.
CC. Male, tail, lateral view.

(A-D after Hammerschmidt, (48),

H-J after Todd (80),

K-N after Christie, (30),

O-Q after Meyer (62),

R-T after Johnston (50),

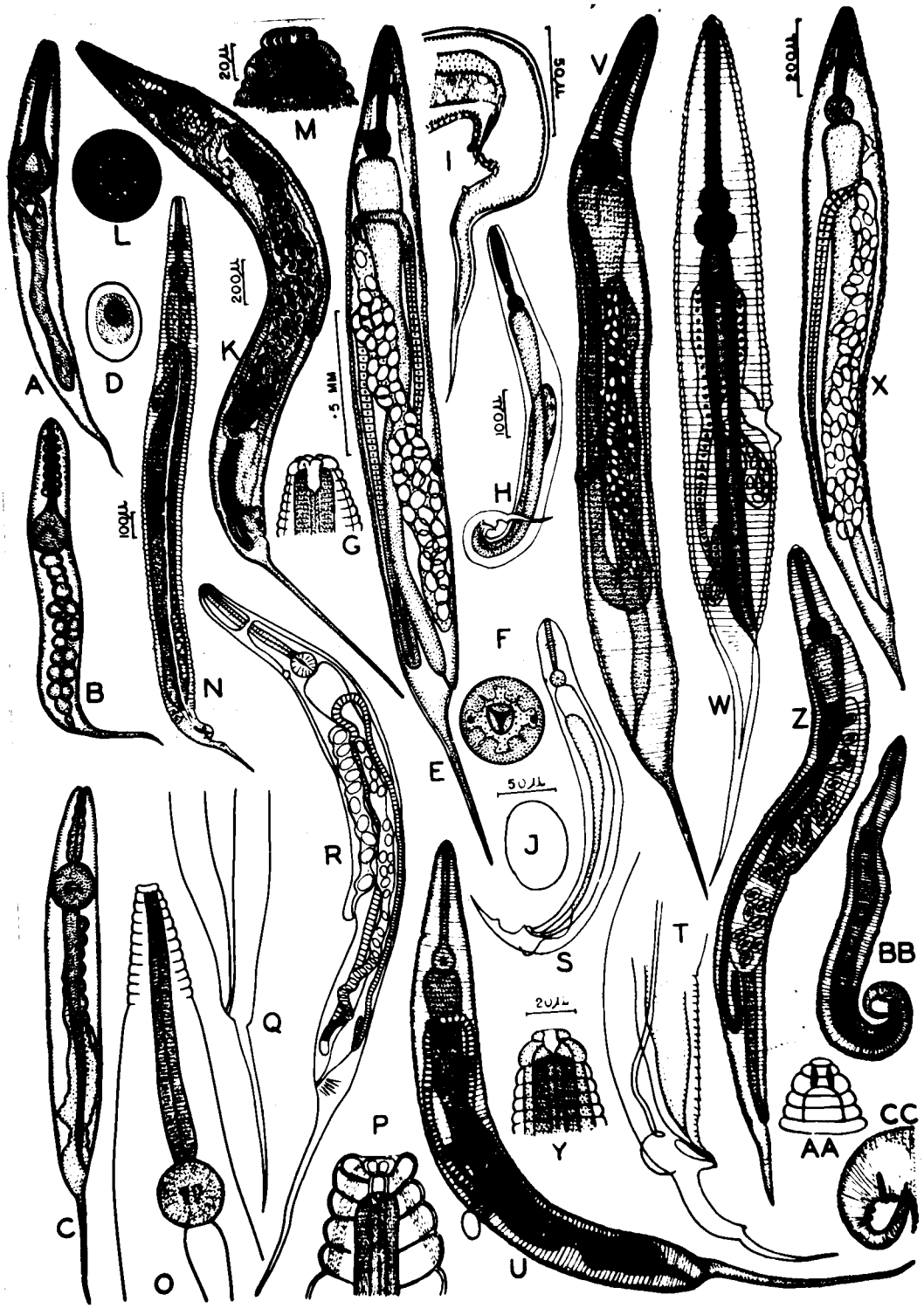
U after Skrjabin (74),

V after Skrjabin (73),

W after Parona (63),

Z-CC after Skrjabin (74).

Remainder original).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GENUS GALEBIA CHITWOOD, 1932

Generic diagnosis.- Thelastomatidae: Oesophagus unusually long, about 30% of body length; intestine enlarged anteriorly to form a cardia. Tail of female short, blunt, with an attenuated caudal appendage distinctly set off. Vulva distinctly posterior, about 77% of the body length from the anterior end; ovary single. Tail of male blunt, bearing a much attenuated dorsal point. Apparently one pair of preanal papillae and three pairs of postanal papillae present. One spicule.

Type species: Galebia aegyptiaca (Galeb,1878) Chitwood, 1932 (Fig.3, A-B).

Galebia aegyptiaca (Galeb, 1878) Chitwood, 1932.

Synonyms: Oxyuris aegyptiaca Galeb, 1878;

Blatticola aegyptiaca (Galeb, 1878) Schwenk, 1926.

Specific diagnosis:- Galebia:

Male: 1 mm. long. Tail as in female, but inserted dorsally. One spicule.

Female: 2.5 to 3.0 mm. long. Mouth tri-lobed. Oesophagus 31% of total body length, consisting of an anterior cylindrical narrow corpus and a posterior valvular bulb. Intestine straight, dilated anteriorly to form a cardia. Tail abruptly set off from body,

terminal. Vulva situated approximately 77% of the total body length from anterior end; ovary single. Egg with a shell consisting of two parts which fit together like the two parts of a "soap-box"; in the two-cell stage when deposited.

Host: Polyphaga aegyptiaca Linn

Location: Presumably large intestine.

Distribution: Africa.

Oxyuris aegyptiaca was first described by Galeb (44) in 1878. Travassos (86) placed this species in the genus Blatticola Schwenk, 1926. In 1930 Chitwood (19) also suggested this but in 1932 (20) removed this species from the genus Blatticola, on the basis of the differences in the form of the oesophagus, the tail, and the eggs, and made it the type species of a new genus for which he proposed the name Galebia.

GENUS BLATTICOLA SCHWENK, 1926

Generic diagnosis:- Thelastomatidae: Mouth sub-triangular, surrounded by eight submedian labio-papillae; amphids present. Oesophagus consisting of an anterior sub-cylindrical part followed by an isthmus (very short in the female), and a posterior valvular bulb. Intestine enlarged anteriorly to form a distinct cardia. Excretory pore posterior to base of oesophagus. Tail of female conical. Vulva situated in posterior third of body; ovary single, doubly reflexed. Eggs oval. Male with single outstretched testis. Tail of male conical, 2 pairs of preanal and 2 pairs of postanal papillae. One spicule.

Type species: Blatticola blattae (Grãeffe, 1860) Chitwood, 1932 (Fig. 3, C-F).

Blatticola blattae (Grãeffe, 1860) Chitwood, 1932.

Synonyms: Oxyuris blattae Grãeffe, 1860;

Oxyuris blatticola Galeb, 1878;

Blatticola blatticola (Galeb, 1878) Schwenk, 1926.

Specific diagnosis.- Blatticola:

Male: 0.78 to 1 mm. long by 54 to 75μ wide. Oesophagus 132 to 170μ long; in a specimen in which the oesophagus was 150μ long, the anterior part 84μ long

by 12μ wide, isthmus 22μ long by 7.5μ wide, and bulb 16μ wide. Nerve ring situated 85 to 100μ from anterior end of body. Excretory pore 218 to 280μ from anterior end of body. Intestine simple; anus 62 to 80μ from posterior end of body. Testis single and outstretched. Tail conical, bearing four pairs of caudal papillae, two pairs pr anal and two pairs postanal. One spicule, 20μ long.

Female: 2 to 3 mm. long by 165μ wide. Cuticle annulated, first annule usually quite strong but those following become less and less marked. Mouth sub-triangular, surrounded by eight sub-median labiopapillae; amphids or lateral organs represented by small circular openings. Oesophagus 158 to 280μ long, consisting of an anterior club-shaped part 230 to 270μ long, followed by a short isthmus, not recognizable in certain cases, and a valvular bulb. Nerve ring 110 to 220μ from anterior end of body. Anterior end of intestine dilated to form a cardia; anus 160 to 240μ from posterior end of body. Tail conical, not filiform. Vulva posterior, 1.65 to 2.5 mm. from anterior end of body. Ovejector directed anteriorly; single unpaired uterus directed anteriorly, relexed near the excretory pore, and extending posteriorly to about the level of the vulva, where it is connected with the short U-shaped oviduct. Ovary

directed anteriorly and reflexed, its blind end being directed posteriorly. Eggs 122 to 126μ long by 38 to 42μ wide, more or less rectangular or oval, pointed at both ends; laid in the four or eight cell stage.

Hosts: Blatta aegyptiaca Linn.;
Blattella germanica Linn.;
Ectobia laponica Linn.;
E. livida Fab.

Location: Rectum.

Distribution: Europe, North America, (?) South America, India, and U.S.S.R.

The genus Blatticola was proposed by Schwenk (70) who cited Oxyuris blatticola Galeb, 1873, as type species. The genus was redescribed by Chitwood (19) in 1930. In 1860 O. blatticola was first described by Graëffe (45) as O. blattae, hence the name of the type species was changed to O.blattae by Chitwood (20). This genus very closely resembles Galebia Chitwood, 1932. The reproductive system in both is the same but due to differences in the form of the oesophagus, the tail, and the eggs, it was thought advisible to let them remain as separate genera. Chitwood (19) also suggested that O.aegyptiaca Galeb probably belongs to Blatticola, but later (20) he separated the two, erecting a separate genu

to accommodate the former, with which view the present writer agrees.

GENUS ARTIGASIA CHRISTIE, 1934

Synonym: Hystrignathus leidyi, 1850 (in part).

Generic diagnosis:- Thelastomatidae:

Male: without any cuticular spines on body, two cephalic rings present in lateral fields; buccal cavity short, corpus cylindrical or lightly claviform; tail short, sub-conical, ending in a blunt terminus, and provided with a dorsal, sub-cylindrical, cuticularized structure extending nearly to terminus. Testis outstretched; one pair of preanal papillae; spicule lacking.

Female: with cervical region generally provided with cuticular spines; cephalic papillae not known. Buccal cavity often considerably elongated. Oesophageal corpus sub-cylindrical, isthmus distinct. Excretory pore posterior to base of oesophagus. Tail attenuated to filiform. Vulva at or slightly posterior to middle of body; reproductive system single. Eggs elongated elliptical.

Type species: Artigasia leidyi (Artigas, 1926) Christie, 1934 (Fig. 3, G-I).

1. Artigasia leidyi (Artigas, 1926) Christie, 1934.

Synonym: Hystrignathus leidyi Artigas, 1926.

Specific diagnosis:- Artigasia:

Male: Identity questionable. (Specific description not given by Artigas).

Female: 2.4 mm. long by 160μ in maximum width. Anterior body provided with rows of external cuticular spines which go as far down as the middle of the oesophageal bulb. Lips salient, 13μ in height. Buccal cavity 38μ long. Oesophagus consists of an anterior claviform corpus, 180μ long by 60μ wide, a narrow isthmus 40μ long and a posterior valvulated bulb with a diameter of 60μ. Anus 380μ from the posterior end of body. Tail filiform. Vulva 1.41 mm. from the anterior extremity. Eggs elongated elliptical, 131μ long by 44μ wide.

Host: "Passalid beetle."

Location: Intestinal diverticulum.

Distribution: São Paulo (Brazil).

2. Artigasia similis (Artigas, 1926) Christie, 1934 (Fig. 3, N).

Synonym: Hystrignathus similis Artigas, 1926

Specific diagnosis:- Artigasia:

Male: unknown.

Female: 1.6 mm. long by 130μ in maximum width. Cuticle of anterior body provided with spines which extend

to the level of the base of oesophagus. Head without any cephalic dilation. Lips salient, 7µ in height. Buccal cavity 38µ long. Oesophagus consists of an anterior claviform corpus, 200µ long by 45µ wide, a short isthmus, 26µ long and a posterior bulb 53µ in diameter. Excretory pore posterior to base of oesophagus, 460µ from the anterior end of body. Nerve ring 150µ from cephalic extremity. Anus 260µ from the posterior end of body. Tail attenuated. Vulva 840µ from anterior extremity. Eggs elongated elliptical, 115µ long by 38µ wide.

Host: "Passalid beetle".

Location: Intestinal diverticulum.

Distribution: São Paulo (Brazil).

3. Artigasia longicauda (Artigas, 1926) Christie, 1934 Fig. 3, O-P).

Synonym: Hystrignathus longicauda Artigas, 1926.

Specific diagnosis:- Artigasia:

Male: Unknown.

Female: 2.6 mm. long by 190µ in maximum width. Cuticle of anterior part of body provided with well developed spines, extending to the level of the middle of the oesophageal bulb. Each spine measures 11µ in length.

Lips salient and pronounced, 7μ in height, and surrounded by a light cuticular ring. Buccal cavity 49μ long. Oesophagus consists of an anterior claviform corpus, 240μ long by 53μ wide, an isthmus 38μ long and a posterior bulb 69μ in diameter. Nerve ring situated in the middle of the corpus. Excretory pore 160μ from the anterior end of body. Anus 508μ from posterior extremity. Tail filiform. Vulva 1.25 mm. from the anterior extremity. Eggs elongated elliptical, 115μ long by 38μ in width.

Host: "Passalid beetle".

Location: Intestinal diverticulum.

Distribution: São Paulo (Brazil).

4. Artigasia hoehnei (Artigas, 1926) Christie, 1934, (Fig. 3.M).

Synonym: Hystrignathus hoehnei Artigas, 1926.

Specific diagnosis:- Artigasia:

Male: Unknown.

Female: 1.55 mm. long by 100μ in maximum width. Cuticle of anterior part of body provided with very small spines which disappear anterior to oesophageal bulb. Head provided with a slight cephalic dilatation, 11μ wide. Lips 7μ in height. Buccal cavity 38μ long. Oesophagus consists of a lightly claviform corpus, 160μ

long by 38µ in maximum width, an isthmus, 30µ long and a posterior bulb 46µ in diameter. Nerve ring situated in the middle of the corpus. Anus 300µ from the posterior end of body. Tail filiform. Vulva 810µ from the posterior extremity. Eggs elongated elliptical, 103µ long by 38µ wide.

Host: "Passalid beetle".

Location: Intestinal diverticulum.

Distribution: São Paulo (Brazil).

5. Artigasia elegans (Artigas, 1926) Christie, 1934. Fig. 3, K.).

Synonym: Hystrignathus elegans Artigas, 1926.

Specific diagnosis:- Artigasia:

Male: Unknown.

Female: 2.6 mm. long by 150µ in maximum width. Cuticle of anterior part of body provided with very small spines which extend to the region of the isthmus. Lips not salient, 7µ in height. Head provided with a cuticular dilatation extending to the middle of the buccal cavity, 16µ wide. Buccal cavity 53µ long. Oesophagus consists of an anterior claviform corpus, 310µ long by 61µ wide, a narrow isthmus 46µ long, and a posterior bulb 77µ in diameter. Nerve ring 230µ from the anterior

end of body. Excretory pore posterior to base of oesophagus. Anus 400µ from the posterior end of body (Artigas gives this distance 190µ but measurements from his diagram come to 400µ). Tail filiform. Vulva 1.43 mm. from the anterior end of body. Eggs elongated elliptical, 126µ long by 53µ wide.

Host: "Passalid beetle".

Location: Intestinal diverticulum.

Distribution: São Paulo (Brazil).

6. Artigasia vesiculosus (Artigas, 1926) Christie, 1934

Synonym: Hystrignathus vesiculosus Artigas, 1926.

Specific diagnosis.- Artigasia:

Male: Unknown.

Female: 2 mm. long by 115µ in maximum width. Cuticle of anterior part of body provided with cuticular spines to the level of the isthmus. Head end provided with a dilatation of cuticle, 46µ long, extending upto the end of the buccal cavity. Lips salient, 15µ in height. Buccal cavity 36µ long. Oesophagus consists of an anterior claviform corpus, 260µ long by 38µ wide, an isthmus 38µ long and a posterior bulb 68µ in diameter. Nerve ring situated 200µ from the anterior end of body.

Anus 460µ from the posterior end of body. Tail filiform. Vulva 1.02 mm. from the anterior extremity. Eggs elongated elliptical, 115µ long by 33µ wide.

Host: Passalid beetle.

Location: Intestinal diverticulum.

Distribution: São Paulo, (Brazil).

7. Artigasia inermis (Artigas, 1926) Christie, 1934 (Fig. 3, Q).

Synonym: Hystrignathus inermis Artigas, 1926

Specific diagnosis:- Artigasia:

Male: Unknown.

Female: 1.74 mm. long by 92µ in maximum width. Cuticle without spines. Lips salient, 7µ in height. Buccal cavity 30µ long. Oesophagus consists of an anterior claviform corpus, 380µ long by u wide, an isthmus 40µ long and posterior bulb 53µ in diameter. Nerve ring slightly anterior to middle of corpus. Anus 190µ from the posterior end of body. Tail attenuated filiform. Vulva 920µ from the anterior extremity. Eggs elongated elliptical, 138µ long by 46µ wide.

Host: "Passalid beetle."

Location: Intestinal diverticulum.

Distribution: São Paulo (Brazil).

8. Artigasia longicollis (Artigas, 1926) Christie,1934 Fig. 3, J).

Synonym: Hystrignathus longicollis Artigas, 1926

Specific diagnosis:- Artigasia:

Male: Unknown

Female: 2.6 mm. long by 120µ in maximum width. Cuticular spines absent. Lips little salient, 10µ in height. Buccal cavity 53µ long. Oesophagus very long, consisting of an anterior subcylindrical corpus 500µ long by 27µ wide, a narrow, little evident, and short isthmus, 38µ in length and a posterior bulb, 69µ in diameter. Anus 360µ from the posterior end of body, tail filiform. Vulva 1.42 mm. from the anterior extremity. Eggs elongated elliptical, 123µ long by 38µ wide.

Host: "Passalid beetle".

Location: Intestinal diverticulum.

Distribution: São Paulo (Brazil).

9. Artigasia politus (Artigas, 1928) Christie, 1934, (Fig. 3, R-S).

Synonym: Hystrignathus politus Artigas, 1928.

Specific diagnosis:- Artigasia:

Male: 720µ long by 75µ in maximum width. Cuticle without spines; lips not salient. Head provided.

with a small cephalic expansion. Oesophagus consists of a corpus 135µ long, an isthmus, and a bulb with a greater diameter of 42µ. Intestine straight. Cloaca sub-terminal, 91µ from the posterior extremity. Testis out-stretched, without an inflexture. Caudal papillae: 1 pair preanal and one pair adanal (little evident). No spicule. Tail very short and truncated and provided with a dorsal, sub-cylindrical, cuticularized structure extending nearly to terminus.

Female: 1.8 mm. long by 140µ in width. Cuticle transversely striated, not provided with spines. Lips not salient. Head provided with a characteristic cephalic expansion. Buccal cavity 4µ long. Oesophagus consists of an anterior cylindrical corpus, 300µ long, a narrow isthmus 35µ long and a posterior end of body. Tail strong and subulate. Ovary single, directed posteriorly and reflexed anteriorly. Uterus with few eggs. Vagina long. Vulva salient 980µ from the anterior extremity. Eggs elliptical, 92µ long by 47µ in width.

Host: "Passalid beetle."

Location: Intestine.

Distribution: São Paulo (Brazil).

Key to the Species of the Genus Artigasia

1. Cervical region provided with spines 2
   Cervical region not provided with spines.....5

2. Head with a cephalic dilatation.....3
   Head without a cephalic dilatation.....4

3. Cephalic dilatation very small.....A. Hoehne
   Cephalic dilatation terminating at the middle of the buccal cavity.....A. elegan
   Cephalic dilatation as broad as the depth of the buccal cavity.....A.Vesiculosus

4. Tail very long.....A. longicauda
   Tail longer than the total length of the oesophagus.....A. leidyi
   Tail shorter than t he total length of the oesophagus.....A. similis

5. Head with a cephalic dilatation.....A. politus
   Head without a cephalic dilatation.....6

6. Corpus of oesophagus long and cylindrical ....A. longicol
   Corpus of oesophagus short and claviform .....A. inermis

DISCUSSION

Artigas (1) described eight new species of nematodes from passalid beetles and placed them in the genus Hystrignathus Leidy, 1850. In 1928 (2) he added one more species to this genus. All the species described by him have only one ovary while H. rigidus, the type species of the genus, has two. On this ground Christie (29) proposed a new genus, Artigasia, to accommodate all nine species of Artigas. Since then no other species has been added to this genus.

LEGENDS

Figure 3

A-B *Galebia aegyptiaca*.

A. Female, entire.
B. Male tail, lateral view.

C-F *Blatticola blattae*.

C. Female, entire.
D. Female, *en face* view.
E. Male, oesophageal region.
F. Male tail, lateral view.

G-I. *Artigasia leidyi*.

G. Female, oesophageal region.
H. Female, tail.
I. Egg.

J. *A. longicollis*.

J. Female, oesophageal region.

K. *A. elegans*.

K. Female, oesophageal region.

L. *A. vesiculosus*.

L. Female, anterior region.

M. *A. hoehnei*.

M. Female, oesophageal region.
N. *A. similis*.
N. Female, oesophageal region.

O-P. *A. longicauda*.

O. Female, oesophageal region.

P. Female, head end, magnified.

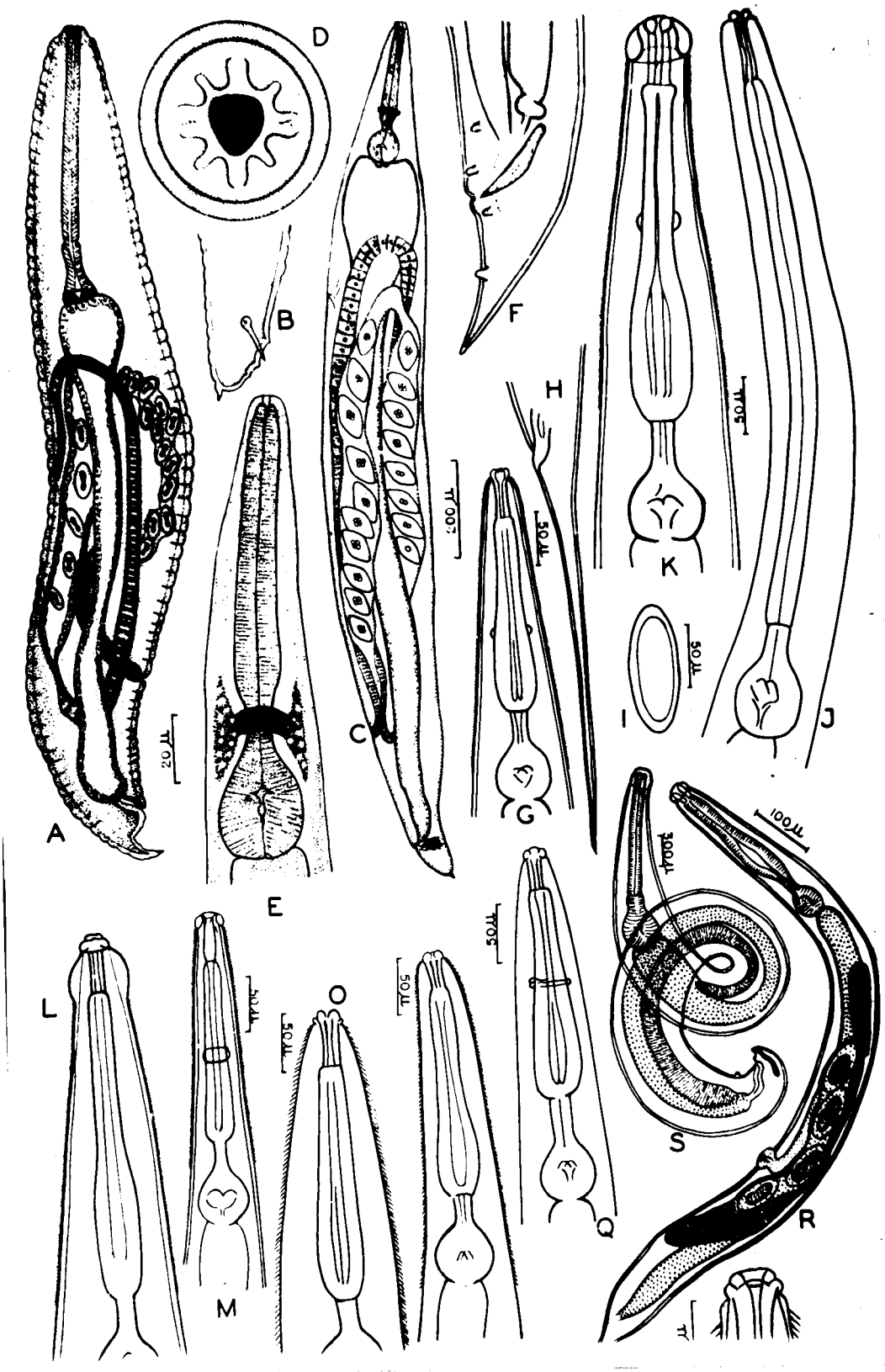
Q. A.inermis.

Q. Female, oesophageal region.

R-S A. politus.

R. Female, entire.
S. Male, entire.

(A-B after Galeb, 1878; C-F after Chitwood, 1930, 1932;
G-S after Artigas, 1926, 1928).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GENUS CEPHALOBELLUS COBB, 1920

Synonyms: Bulhöesia Schwenk, 1926 (in part);
Scarabanema Christie, 1931.

Generic diagnosis:- Thelastomatidae: Mouth opening subtriangular, surrounded by eight labio-papillae. Buccal cavity short and may or may not be armed with three cuticular teeth. Oesophagus consisting of an anterior nearly cylindrical corpus, a distinct isthmus and a posterior valvular bulb. Tail conical. Excretory pore much behind the base of oesophagus. Vulva from middle to almost posterior third of body. Ovaries two; uteri divergent. Eggs usually numerous, oval or elliptical. Male much smaller than the female; tail ending in a slender caudal spike; caudal papillae: a pair of preanal papillae, a pair of weakly developed papillae opposite the anus, a single median double papilla slightly posterior to anus, and a pair of papillae on the base of the caudal spike. Excretory pore posterior to base of oesophagus.

Type species: Cephalobellus papilliger Cobb, 1920.

1. Cephalobellus papilliger Cobb, 1920 (Fig. 4, A-G).

Synonym: Scarabanema cylindricum Christie, 1931.

Specific diagnosis:- Cephalobellus:

Female: Body nearly cylindrical, 3.5 to 6 mm. long. Cuticle coarsely striated. Striae 6 to 10µ in anterior body. Alae absent. Head sub-truncate, head annule 10µ wide. First annule behind the head 15 to 18µ wide. The anterior 10 to 12 annules more conspicuous than those on the rest of the body. Mouth opening sub-triangular, surrounded by eight labio-papillae. Amphids present. Buccal cavity conical, provided with three inward and forward pointing triangular cuticular plates. Oesophagus consists of an anterior corpus which gradually increases in diameter posteriad, abruptly reducing before joining the isthmus, an isthmus having a diameter about two-thirds of the adjacent end of the corpus, and a posterior valvular bulb with a diameter of about four-sevenths of the corresponding body diameter. Intestine dilated anteriorly to form a slight cardia, the form of cardia varying in different individuals. Rectal glands present; probably three in number. Anus about 250µ from posterior end of body. Tail conical, in some forms tends to be attenuated. Excretory system H-shaped. Excretory pore 500µ posterior to base of oesophagus. Excretory ducts conspicuous in region of excretory pore. Nerve ring at three-fourth the length of the corpus from

the anterior end. Vulva near middle of body, 1.82 to 3.12 mm. from the anterior end, not salient. Vagina directed anteriorly, equal to the corresponding body diameter in length. Uteri divergent, ovaries two. Eggs numerous, ellipsoidal, 70µ long by 45µ wide, deposited before segmentation.

Male: Body moderately slender, 1.15 mm. long by 54µ wide at middle of body. Cuticle faintly, rather finel striated, striae 1.5 to 2µ apart in the neck region, increasing to about 3µ in the middle of body. Head subtruncate. Buccal cavity short, nearly non-existent. Anterior portion of oesophagus nearly cylindrical, 15µ wid in the middle, isthmus not distinct, oesophageal bulb valvulated and slightly elongated, 34µ long by 29µ wide. Intestine slightly expanded at its anterior end. Anus slightly salient, 80µ from the tip of the tail; tail in form of a caudal spike. Testis reflexed; one spicule, 43µ long, not expanded at proximal end, ending distally in form of a sharp point, and expanded in the middle to a diameter of 5µ. One pair of preanal papillae 32µ in front of anus, one on each side of the anus, one median postanal double papilla slightly posterior (about 5µ) to the anus, a a pair of postanal papillae about 25µ behind the anus.

Abdul Basit Kha.

T18

Host: Scarabaeid larvae belonging either to the Melolonthinae or the Rutelinae.

Location: Posterior end of intestine.

Distribution: Woods Hole, Mass., U.S.A.

2. Cephalobellus leuckarti (Hammerschmidt, 1838), Christie 1933 (Fig. 4, H-I).

Synonyms: Oxyuris leuckarti Hammerschmidt, 1838;

Oxyuris brachyura Hammerschmidt, 1847;

Scarabanema leudkarti (Hammerschmidt, 1838) Christie, 1931.

Specific diagnosis:- Cephalobellus:

Male: Unknown.

Female: 4.25 to 8.4 mm. long by 423µ in maximum width. Body in general cylindrical, neck region distinctly conoid. Oesophagus consists of a nearly cylindrical anterior corpus, an isthmus slightly less in diameter than the corpus and a posterior oblong bulb. On both sides of the oesophagus pass fibrous thread-like structures, which extend from the head to the base of the oesophageal bulb. Intestine dilated anteriorly to form a club-shaped cardia, it also presents a lesser posterior dilatation. Tail ending in a short caudal spike which forms only about 1/40 of the body length. Vulva near middle of body, not salien Along the course of the vaginal canal and on both sides of it are several separate, single, yellowish, spindle-shaped

bodies, (Hammerschmidt figures 3 and suggests a glandul
function for them). Ovaries two, uteri divergent. Eggs
oval, 84 to 100μ long by 70μ wide; segmentation starts i
uterus.

Host: Believed to have been the larvae of Amphimallon assimilis Host. (= Rhizotrogus aprilianus) and A. solstitialis L. (= R. solstitialis).

Location: Posterior end of intestine.

Distribution: Germany.

This species can be distinguished from C.papilliger by its larger eggs and by the presence of three conspicuous yellow bodies near the vagina.

3. Cephalobellus brevicaudatum (Leidy, 1851) Christie, 1933 (Fig. 4, J-N).

Synonyms: Thelastoma brevicaudatum Leidy, 1851;
Thelastomum brevicaudatum Leidy, 1853;
Aorurus (Thelastoma) brevicaudatus (Leidy) 1851) Walton, 1927;
Scarabanema brevicaudatum (Leidy, 1851) Christie, 1931;
Thelastoma indiana Basir, 1940;
Cephalobellus lloydi Baylis, 1946.

Specific diagnosis:- Cephalobellus:

Male: 0.66 to 1.2 mm. long by 40 to 80μ in

maximum width. Cuticle transversely striated throughout the greater part of body; striae rather coarse in the region of head, increasing in width posteriorly, almost 8 to 10μ in the region of the bulb. Oesophagus 150 to 260μ long; bulb with isthmus 46 to 80μ long by 26 to 50μ in greatest width. Nerve ring 84 to 110μ and excretory pore 230 to 360μ from anterior end of body. Anus 50 to 100μ from tip of tail; tail narrowing rather suddenly to form a tapering terminal filament of variable length. Caudal papillae consisting of one pair of preanal, one pair of adanal, and two median postanal double papillae. Of the latter the more anterior is immediately behind the anus, the other on the narrow portion of the tail. Possibly a fifth pair of sensory organs may be present since, according to Bayli in a ventral view there appears to be a faint indication of a pair of nerve endings, or possibly pores, a little in front of the posterior double papilla. One spicule, 25 to 55μ long. Testis reflexed.

Female: 2.48 to 4.23 mm. long by 260μ wide. Body in general cylindrical, rapidly narrowing anteriad from the cardiac bulb, producing a conical neck region. Body narrows abruptly in anal region, producing a very short spiculate tail. Cuticle conspicuously striated throughout the whole length of the body except the tail.

First annule 15μ wide; remaining annules 8 to 10μ wide and more posteriorly 12μ apart. Oral opening sub-triangular, surrounded by eight papillae. Amphids present. Buccal cavity short and wide containing one dorsal and two sub-ventral cuticular elevations. Oesophagus 350 to 486μ long, consisting of a corpus, an isthmus and a posterior valvulated bulb. The latter 90 to 102μ long by 90μ wide. Corpus plus isthmus 260 to 384μ long by 38 to 40μ in maximum width. Nerve ring 150μ from the anterior end of body in a specimen 2.48 mm. long. Excretory pore posterior to base of oesophagus. Intestine enlarged anteriorly to from a slight cardia, also presenting a lesser posterior dilatation in the rectal region. Tail conical. Anus 310μ from the posterior end and vulva 1.48 mm. from the anterior end of body in a specimen 2.48 mm. long, the latter lying between middle and posterior third of body. Vagina directed anteriorly, uteri divergent; ovaries two. Eggs oval or ellipsoidal, 75 to 89μ long by 25 to 33μ wide.

Host: Larva of Ligyrodes relictus (Say) (= Scarabaeus relictus); Leucophaea sp. (Blattidae), Larvae of Tipulids (crane-flies) possibly Tipula peliostigma Schummel and T. oleracea L.

Location: Intestine.

Distribution: Near Philadelphia, Pa. (U.S.A.); North India; England.

This species differs from all other species of this genus in the position of its vulva which in this cas lies much posterior to the middle of the body while in others it is almost at the middle, and in the shape and size of its eggs.

4. Cephalobellus magalhãesi (Schwenk, 1926) n. comb. (Fig. 4, O-Q).

Synonyms: Bulhoesia magalhãesi Schwenk, 1926;

Thelastoma magalhãesi (Schwenk, 1926) Travassos, 1929.

Specific diagnosis:- Cephalobellus:

Male: unknown.

Female: 3.4 to 4 mm. long by 300 to 350µ wide. Cuticle transversely striated upto the level of the oesop agus. Lips not salient. Buccal cavity about 7µ deep. Oesophagus 465µ long, consisting of an anterior cylindrical corpus, 340µ long by 42µ wide; an isthmus 25µ long; and a posterior valvular bulb 100µ in diameter. Intestin dilated anteriorly to form a cardia. Nerve ring 250µ fr the anterior end of body. Excretory pore posterior to bas of oesophagus, 710µ from the anterior extremity. Anus 500µ from posterior end of body; tail short, attenuated conical. Vulva just behind the middle of body,

1.6 mm. from the caudal end. Ovaries lying in the opposite direction to their corresponding uteri and refle near their termination; uteri divergent. Eggs ellipsoida almost spherical, 70µ long by 60µ wide; segmentation star in uterus.

Host: "Barata selvagem" (= wild roach).

Location: Presumably intestine.

Distribution: Brazil (São Paulo).

This species can easily be distinguished from all other species of this genus by its comparatively longer tail and almost spherical eggs.

Key to the Species of the Genus Cephalobellus

1. Vulva almost at middle of body; eggs less than twice as long as broad.....2
   vulva about 60% of body length from the anterior end; eggs almost twice as long as broad..C.brevicaudat

2. Tail very short, less than one-tenth of body length.....3
   Tail attenuated conical; about one eighth or more as long as the body.....C.magalhães

3. Eggs ellipsoidal to spherical, 88 to 110μ long by 73μ wide; female with three conspicuous yellowish bodies near vagina.....C. leuckarti
   Eggs smaller, oval, 70μ long by 45μ wide; females without any yellowish bodies near vagina.....C. papillige

DISCUSSION

The genus Cephalobellus was proposed by Cobb (34), who described a nematode from a beetle larva under the name of C. papilliger. He described only the male and his description was not accompanied by any diagrams of the worm. Christie (27) proposed a new genus, Scarabanema, for a worm he got from coleopterous larvae and called it S. cylindricum. He also placed Oxyuris leuckarti Hammerschmidt, 1838, and Thelastoma brevicaudatum Leidy, 1851, in this genus. In 1933 (28) he made the genus Scarabanema a synonym of Cephalobellus as the males of the two were identical, making S. cylindricum a synonym of C. papilliger. Basir (5) described a nematode from a cockroach calling it Thelastoma indiana. Later (12) he made this species as well as C. lloydi Baylis, 1946, a synonym of C. brevicaudatum. Schwenk (70) had proposed a new genus Bulhõesia, in which he had placed three new species, B. magalhãesi, B. iceni, and B. severianoi. The present author thinks that B. magalhãesi agrees in essential structure with the genus Cephalobellus and could be easily accommodated here. It has been removed accordingly and named C. magalhãesi. Thus the genus Cephalobellus now contains four species viz. C. Papilliger, C. leuckarti, C. brevicaudatum, and C. magalhãesi.

LEGENDS

Figure 4

(A-G) Cephalobellus papilliger

A. Female, anterior region.
B. Female, posterior end.
C. Female, head end, magnified.
D. Female, en face view.
E. Male, anterior region.
F. Male tail, lateral view.
G. Male tail, ventral view.

(H-I) C. leuckarti

H. Female, entire.
I. Female, reproductive organs.

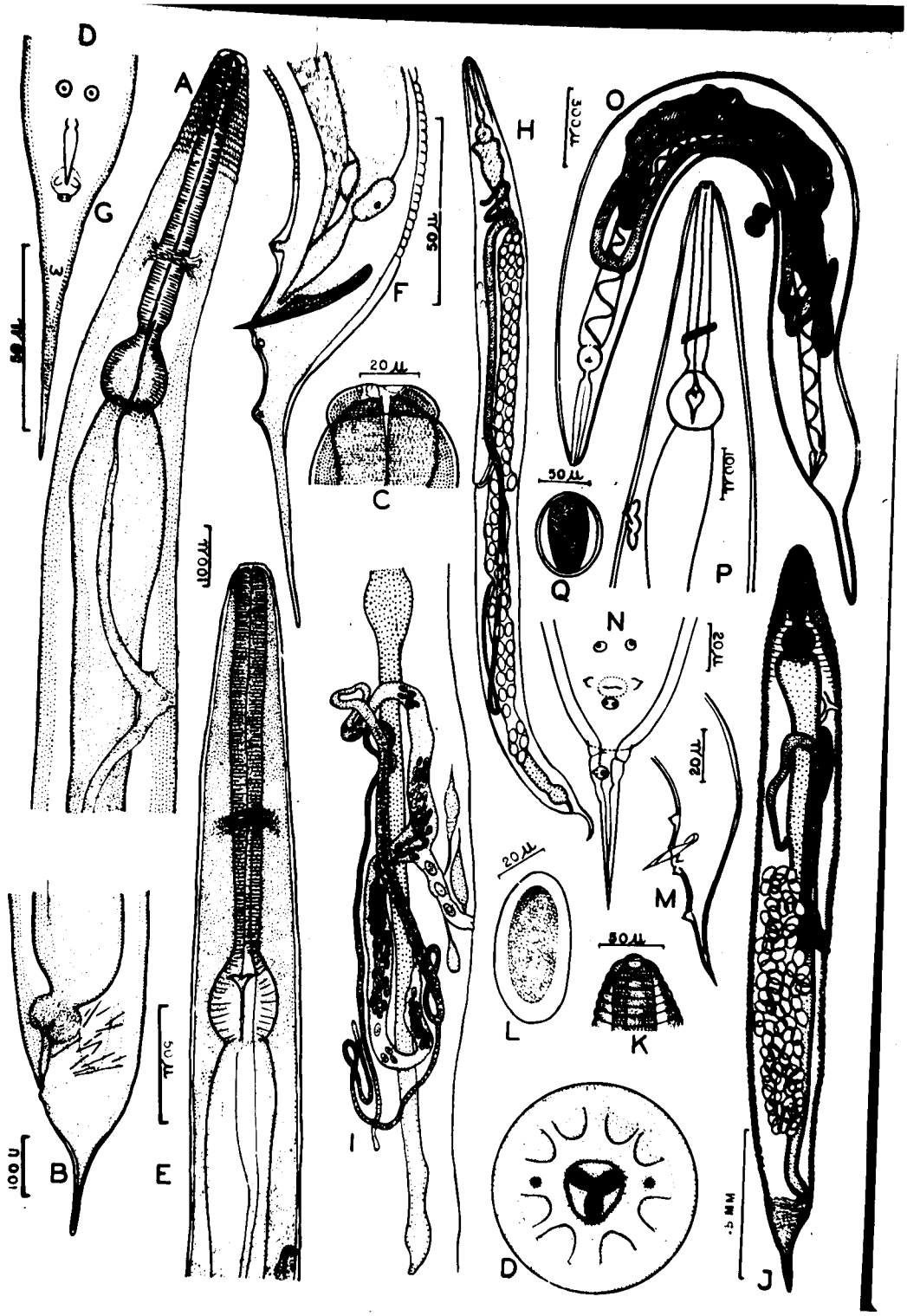
(J-N) C. brevicaudatum

J. Female, entire.
K. Female, head end, magnified.
L. Egg.
M. Male tail, lateral view.
N. Male tail, ventral view.

(O-Q) C. Magalhães

O. Female, entire.
P. Female, anterior region.
Q. Egg.

(A-G after Christie, (27); H, and I after Hammerschmidt, (47)(48); M. and N after Baylis, (14); O-Q after Schwenk, (70).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20 µ
50 µ
100 µ

GENUS SEVERIANOIA SCHWENK, 1926 in TRAVASSOS, 1929

Generic diagnosis:- Thelastomatidae: Mouth opening surrounded by a circumoral elevation; eight sub-median papillae, the two medio-dorsal and two medio-ventral papillae large, flat, labiopapillae; the four medio-lateral papillae much smaller, more typically papilloid in character; amphids or lateral organs present. Mouth cavity containing one dorsal and two sub-ventral tooth-like projections. Oesophagus of female consisting of an anterior clavate part followed by an indistinct isthmus and a valvular bulb. Oesophagus of male similar but having a distinct isthmus. Intestine enlarged anteriorly to form a cardia. Tail of female conical or attenuated. Excretory pore posterior to base of oesophagus. Vulva near middle of body; two ovaries; amphidelphic. Eggs bearing longitudinal lines. Tail of male conical, not filiform. One spicule.

Type species: Severianoia severianoi (Schwenk, 1926) Travassos, 1929.

1. Severianoia severianoi (Schwenk, 1926) Travassos, 1929 (Fig. 5, A-E).

Synonym: Bulhõesia severianoi Schwenk, 1926

Specific diagnosis:- Severianoia:

Male: 900µ long by 62µ wide. Anterior part of oesophagus 277µ long by 38.5µ wide; isthmus 54µ long; bulb 69µ long. Testis extending to within 308u of bulb. Intestine simple; anus 115µ from posterior end of body. Tail conical or attenuated. Caudal papillae consisting of one pair of adanal papillae and two pairs of postanal papillae. One spicule, 38.5µ long.

Female: 3 to 3.5 mm. long by 350 to 425µ wide. Cuticle transversely striated, striae accentuated anteriorly. Lips salient (?), mouth small. Oesophagus 525 to 550µ long, anterior part 50µ wide, isthmus 25µ long, bulb 125µ long. Nerve ring near middle of oesophagus. Intestine dilated anteriorly; anus 100 to 200µ from posterior end of body. Tail short, conical. Vulva 1.5 to 1.9 mm. from anterior end of body; uteri divergent, sacciform, anterior branch reflexed; anterior ovary directed posteriorly and reflexed, posterior ovary directed anteriorly, bent dorsally and terminated in a short posterior flexture. Eggs ellipsoidal, 69 to 77µ long by 30µ wide, bearing four sinuous longitudinal lines, deposited in morula stage.

Host: "Barata selvagem" (= wild roach) and Pycnoscelus surinamensis Linn

Location: Intestine.

Distribution: South America (São Paulo, Brazil), and North America (U.S.A., Paradise Key, Florida).

2. Severianoia magna (Pereira, 1935) (Fig. 5, F-I).

Specific diagnosis:- Severianoia:

Male: 600µ long by 60µ in width. Mouth with salient lips (?) and a buccal capsule. Oesophagus consists of an anterior cylindrical corpus 240µ long and a round valvular bulb 30µ in diameter. Tail pointed, 50µ long, bearing a pair of sub-ventral pre-cloacal papillae and two pairs of post-cloacal papillae at about the same level. Spicule one, 49µ long.

Female: 6.5 to 7.7 mm. long. Oesophagus consists of an anterior cylindrical corpus 0.9 to 1.1 mm. in length, a narrow isthmus 60µ long and a posterior valvular bulb 120 to 160µ in diameter. Tail conical, 320 to 460µ in length. Nerve ring 460 to 480µ from anterior extremity. Excretory pore posterior to base of oesophagus, 1.3 to 1.7 mm. from the anterior extremity. Eggs with one surface flattened, 98µ long by 36 to 41µ wide, bearing longitudinal lines.

Host: "Blattidae silvestris".

Location: Intestine.

Distribution: São Paulo (Brazil).

This worm has exactly the same body proportions as the type species, and in the opinion of its author

(Pereira, 1936) there are no differences between the two other than differences in dimensions. The present writer first thought of making this a synonym of the latter as in representatives of the family Thelastomatidae such variations in size are not very uncommon, but after due consideration he thought it proper to give this worm the status of a separate species as intergrades between the two extremes have not been met with. Moreover, apart from the size of the worm, there is a difference in the size of the eggs; in the type species these measure 69 to 77μ long by 30μ wide while in S.magna they are 98μ long by 36 to 41μ wide.

3. Severianoia dubia Travassos, 1929 (Fig. 5, J-K).

Specific diagnosis:- Severianoia:

Male: Unknown.

Female: 1.9 to 2.3 mm. long by 150 to 200μ wide. Cuticle striated. Mouth opening circular, with a diameter of 8μ, surrounded by lips, and followed by a cylindrical buccal capsule, 8μ deep by 12μ wide. Oesophagus 490 to 520μ long, consisting of an anterior cylindrical corpus and a posterior bulb which has a diameter of 80 to 100μ long. Intestine straight; tail conical, 240 to 290μ long. Excretory pore posterior to base of oesophagus. Nerve ring 200μ from the anterior

extremity. Vulva between middle and posterior third of body; ovejector directed anteriorly. Uteri divergent; ovaries two, both converging towards the anterior extremity, their blind ends being directed anteriorly; prodelphic. Eggs flattened on one side, with distinct longitudinal lines or crests, 78µ long by 32 to 35µ wide.

Host: Myriapoda (Julidae).

Location: Intestine.

Distribution: Brazil.

4. Severianoia glomeridis (v. Linstow, 1885) n. comb. (Fig. 5, L-O).

Synonyms: Oxyuris glomeridis v. Linstow, 1885;

Oxyuris ovocostata v. Linstow, 1886;

Thelastoma glomeridis (v. Linstow, 1885) Travassos, 1929;

Thelastoma glomeridis (v. Lindtow, 1886) Travassos, 1929.

Specific diagnosis:- Severianoia:

Male: 740u long by 52µ wide. Mouth opening transversely placed, surrounded by four small papillae. Oesophagus 172µ long ending in a posterior valvular bulb. Anus 74µ from posterior end of body; tail constituting about one-tenth of body length. Excretory pore posterior to base of oesophagus. Caudal papillae three pairs, one

pair preanal, and two pairs postanal. One spicule, 26μ long.

Female: 3.7 mm. long by 200μ wide. Body transversely striated, striae about 10μ apart; head annule bigger than the remainder. Oesophagus 616μ long consisting of a cylindrical corpus, an isthmus and a posterior valvular bulb. Nerve ring slightly anterior to middle of oesophagus. Anus 370μ from posterior end of body. Tail conical, forming about one-tenth of the body length. Vulva slightly anterior to middle of body dividing it in the ratio of 34:37. Eggs 79 to 86μ long by 39 to 43μ wide, bearing six longitudinal lines, the latter arising from a common point at one pole and ending free near the other pole. Segmentation begins before deposition, eggs being laid in four-celled stage.

Host: Glomeris limbata, larva of "Citonia aurata" (Coleoptera).

Location: Intestine.

Distribution: Germany.

SPECIES INQUIRENDA

Severianoia gracilis (Hammershmidt, 1838) n. comb. (Fig. 5, P).

Synonyms: Oxyuris gracilis H-m., 1838;

Thelastoma gracile (Ham., 1838)Leidy,1851;

Thelastomum gracile (Ham., 1838) Leidy 1853;

Aorurus (Thelastoma) gracilis (Ham.,1838) Walton, 1927;

Anguillula gracilis Diesing, 1850-51

Specific Diagnosis:- (?) Severianoia:

Male: Unknown.

Female: 1.59 mm. long. Cuticle striated; striae more distinct in the oesophageal region. Oesophagus 317μ long, forming about one-fifth of the body length. Tail in form of a caudal spike, 176μ in length, constituting one-n of the body. Two ovaries, both lying anteriorly. Develop eggs in the uterus are distinctly visible only in the post erior third of the body.

Host: Larva of Polyphylla fullo (= Melolontha fullo)

Location: Intestine.

Distribution: Germany

The data given by Hammershmidt (48) are not enough to make a definite diagnosis of this species.

However, the shape and size of the tail suggests that this

may either belong to the genus Cephalobellus or to Severianoia, the difference between these two genera primarily being in the character of the eggs. In the absence of any description of the eggs of this species, the task of assigning it to any one of these genera becomes the more difficult. However, the disposition of the ovaries is very similar to that of S. dubia, and because of this similarity the writer has placed this species in the genus Severianoia as a species inquirenda.

Key to the Species of the Genus Severianoia

1. Vulva at about middle of body, ovaries didelphic, tail 3 to 6% of body length 2
   Vulva between middle and two-thirds of body. ovaries prodelphic, tail 12 to 13% of the body length.....S. dubia

2. Eggs bear six longitudinal lines... S. glomeridis
   Eggs bear less than six longitudinal lines.....3

3. Females 3 to 3.5 mm. long, eggs 69 to 77µ by 30µ.....S. severianoi
   Females above 6 mm. long, eggs 98 by 36µ to 41µ.....S.magna

DISCUSSION

Schwenk (70) created the genus *Bulhõesia* to accommodate three species from cockroaches namely B. magalhãesi, B. icemi, and B.Severianoi. Travassos (36) transferred the first two species to the genus Thelastoma and made the third species the type of a new genus which he called Severianoia (Schwenk, 1926). He also added another species to this genus naming it S. dubia. Pereira (64) described a third species, S.Magna. The present writer has transferred Oxyuris glomeridis v. Linstow, 1885, to this genus and has placed Oxyuris gracilis Hammerschmidt, 1838 as a species inquirenda in it.

GENUS EURYCONEMA CHITWOOD, 1932

Generic diagnosis: Thelastomatidae: Mouth surrounded by a circumoral elevation; eight submedian papillae and amphids in female. Oesophagus consisting of an anterior club-shaped part set off from the valvular bulb by a short isthmus. Vulva approximately at middle of body. Eggs elongate oval, flattened on one side. Tail of female filiform. Tail of male very short and bearing two pairs of caudal papillae, one pair of preanal papillae, and one pair of heavily cuticularized postanal papillae

Type species: Euryconema paradisa Chitwood, 1932.

Euryconema paradisa Chitwood, 1932 (Fig. 5, Q-S).

Specific diagnosis:- Euryconema:

Male: 1.02 mm. long by 130µ wide. Head distinctly set off from cervical region. Oesophagus 280µ long; anterior part club-shaped, 240µ long; pyriform bulb 50µ wide. Intestine simple; anus 55µ from posterior end of body. Tail bearing a very delicate spine 31µ long. One pair of large preanal papillae and one pair of smaller postanal caudal papillae. Preanal cuticular modifications present (see Fig.5S). One spicule, 55µ long.

Female: 3.1 to 3.4 mm. long by 360µ wide. Head distinctly set off from first annule; mouth nearly circu surrounded by a circumoral elevation; eight submedian p illae present; amphids prominent. Oesophagus 480 to 52 long; anterior part club-shaped, 365µ long by 60 to 65µ wide; isthmus not distinct; bulb 123 to 130µ wide. Nerv ring and excretory pore not observed. Intestine enlarge anteriorly to form a cardia; anus 900µ to 1.1 mm. from anterior end of body; ovejector directed posteriorly; amphidelphic. Egg 100 to 128µ long by 40 to 52µ wide.

Host: Eurycotis floridana Walker.

Location: Rectum.

Distribution: United States (Paradise Key, Florida).

GENUS SUIFUNEMA CHITWOOD, 1932

Generic diagnosis:- Thelastomatidae: Mouth opening prismoidal, surrounded by a circumoral elevation; eight submedian labiopapillae; amphids present. Oesophagus consisting of a simple, cylindrical anterior part distinctly set off from the isthmus; isthmus not distinct set off from the posterior bulb. Tail of female short, bluntly rounded or slightly conical, bearing a short filiform caudal projection. Excretory pore posterior to base of oesophagus. Vulva anterior, approximately 25% of the body length from the anterior, end (Chitwood gives its position as approximately 40% but by his description and by measuring from his diagram it comes to about 25%); amphidelphic. Eggs with distinct polar cap (?).

Type species: Suifunema caudelli Chitwood, 1932.

Suifunema caudelli Chitwood, 1932 (Fig. 5, T-U).

Specific diagnosis:- Suifunema:

Male: Unknown.

Female: 1.7 to 2.18 mm. long by 270 to 340μ wide. Mouth surrounded by eight submedian labiopapillae. Head distinctly set off, followed by an enlarged annule. Oesophagus 270 to 340u long; consisting of an anterior club-shaped part 220 to 238μ long by 27 to 32μ wide, an isthmus 22 to 34μ long by 15 to 20μ wide, and a valvular

bulb 80 to 90μ wide. Nerve ring situated in the region of the isthmus. Excretory pore 310 to 490u from anterio end of body. Intestine enlarged anteriorly to form a cardia; anus 1.52 to 2 mm. from anterior end of body. Tail rounded, bearing a filiform, attenuated, caudal appendage 136 to 181μ long; the latter becomes more attenuated in older females. Vulva 430 to 510u from anterior end of body; ovejector directed posteriorly; amphidelphic. Egg rounded, elongate, 60 to 79μ long by 30 to 38μ wide; in morula stage when deposited; shell thin; polar cap conspicuous (?).

Host: Steleopsyga sinensis Walker

Location: Rectum.

Distribution: Asia (Suifu, Szchuen, China).

LEGENDS

Figure 5

(A-E) *Severianoia severiani*

A. Female, entire.
B. Female, *en face* view.
C. Eggs.
D. Male, entire.
E. Male tail, lateral view.

(F-I) *S. magna*

F. Female, anterior region.
G. Female, head end, magnified.
H. Female, tail.
I. Male tail, lateral view.

(J-K) *S. Dubia*

J. Female, entire.
K. Female, head end magnified.

(L-O) *S. glomeridis*

L. Female, Oesophageal region.
M. Male, entire.
N. Male, tail, ventral view.
O. Egg.

(P) *S.gracilis*

P. Female, entire.

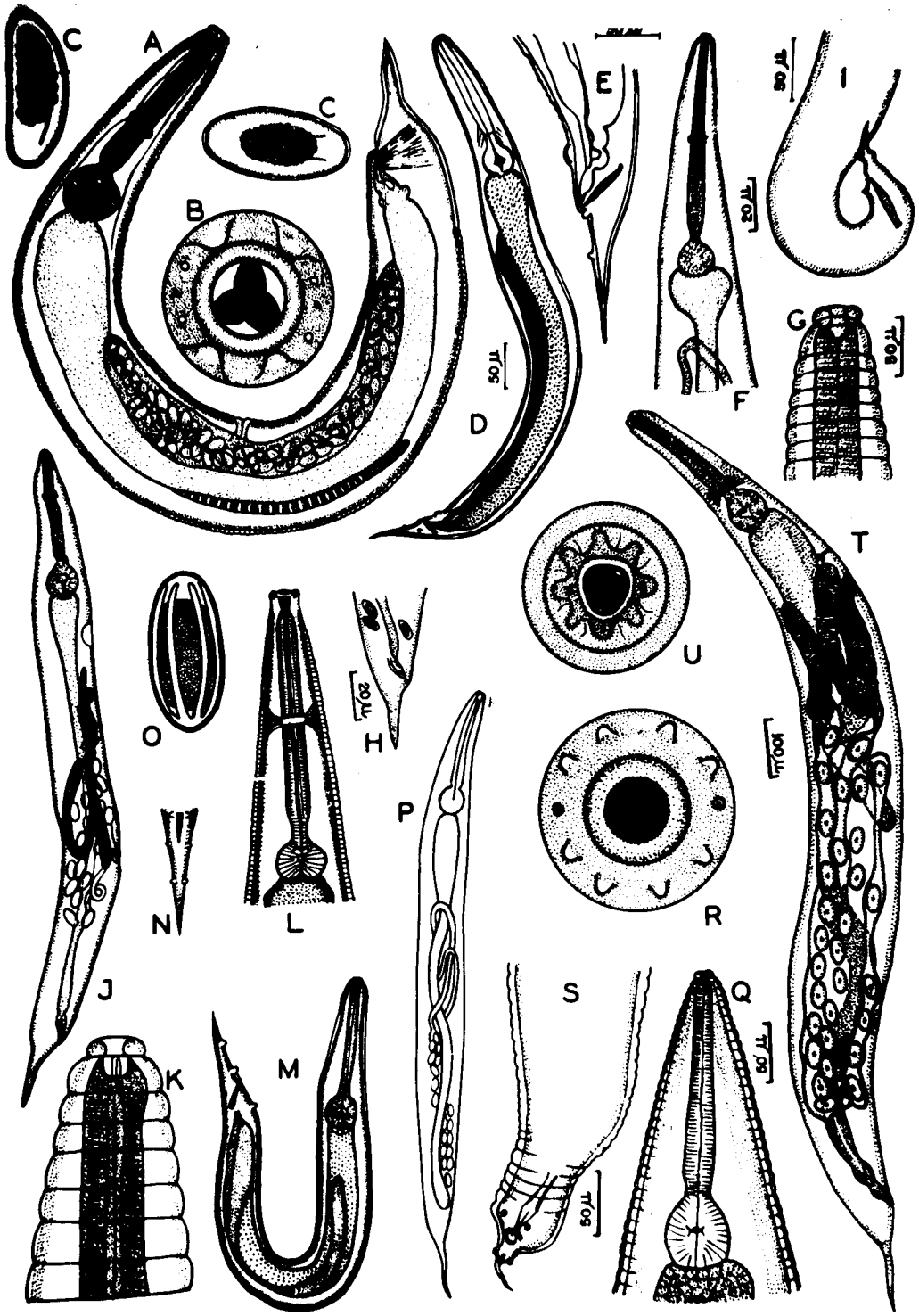
(Q-S) *Euryconema paradisa*

Q. Female, oesophageal region.
R. Female, *en face* view.
S. Male tail, ventro-lateral view.

(T-U) *Suifunema caudelli*

T. Female, entire.
U. Female, *en face* view.

(A-C after Chitwood, (20); D-E after Schwenk, (70); F-I after Pereira, (64); J-K after Travassos, (86); L-O after von Linstow, (59)(60); P after Hammerschmidt, (47); Q-U after Chitwood, (20).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GENUS GRYLLOPHILA BASIR, 1942

Synonyms: Thelastomum Leidy, 1850 (in part),
Neyraiella Serrano Sanchez, 1947

Generic diagnosis:- Thelastomatidae: Male much smaller than the female. Female mouth opening sub-triangular surrounded by a circumoral elevation and eight labiopapillae. Oesophagus consisting of a corpus, an isthmus and a valvular bulb. Intestine dilated anteriorly to form a bulky cardia which suddenly narrows into a rather thin intestine. Vulva 77% of body length from the anterior end. Ovaries two; uteri parallel, running posteriad and meeting to form a single uterus which runs in an anterior direction, is reflexed at the level of the excretory pore and runs posteriad until it meets the vagina; vagina long. Eggs unusually large, ellipsoidal, thick-shelled, bearing spine-like outgrowths, laid in two-celled stage, and passed in the form of a chain enclosed in a tubular structure which is formed most probably by mucous secretion of the oviduct. Tail of female conically attenuated, ending in a short, pointed appendage. Tail of male short, ending in a pointed appendage which is abruptly set off from the body; caudal papillae three pairs, the first two being in the vicinity of the anus, the first slightly preanal and the second, slightly postanal, the third lying near the tip of the tail where the caudal appendage arises.

Type species: Gryllophila skrjabini (Sergiev, 1923) n. comb. (Fig. 6, A-J)

Gryllophila skriabini (Sergiev, 1923) n. comb. (Fig.6,A-J).

Synonyms: Thelastomum skriabini Sergiev, 1923
Gryllophila gryllophila Basir, 1942
Neyraiella neyrae Serrano Sánchez, 1947.

Specific diagnosis:- Gryllophila:

Male: 1.17 mm. long by 170μ in maximum width. Body distinctly annulated throughout its length. First annule large, about 40μ wide, second annule 15μ wide, and th following annules increasing regularly in size until they reach a width of about 40μ at about the middle of the body; posterior to middle of body they again decrease in size, the final annule being about 22μ in width. Buccal cavity short and cylindrical, 12μ deep by 8μ wide. Oesophagus 200μ long; corpus 115μ long by 20μ wide; isthmus 40μ long by 10μ wide; bulb 45μ long by 40μ wide. Nerve ring 125μ from anterior end of body. Excretory pore much behind the base of oesopha about 440μ from the anterior end. Anus 115μ from the posteri extremity situated on a prominence (in a preserved specimen) Tail short, ending in a pointed appendage which is set abrup off from the body. Caudal papillae three pairs, the first two pairs situated on the anal cone, the first pair slightly preanal and the second pair slightly postanal, and the third pair lying near the tip of tail at the origin of the caudal appendage. One spicule, 50μ long.

Female: 2.25 to 3.1 mm. long. The following measurements are taken from a worm 3 mm. long by 410μ in maximum.

width. Cuticle conspicuously striated; first annule 17μ wide; width of the following annules increases regularly until the ninth annule which is 50μ wide; posterior to the ninth annule a width of 30 to 40μ is maintained almost regularly; behind the vulva they may decrease to 10μ only. Oral opening subtriangular, surrounded by a circumoral elevation and eight labiopapillae; amphids present. Buccal cavity cylindrical, 20μ deep by 10μ wide. Oesophagus 420μ long, consisting of a corpus 290μ long by 45μ wide, an isthmus 30μ long by 35μ wide, and a valvular bulb 100μ long by 110μ wide. Nerve ring 240μ from anterior end of body. Excretory pore very much posterior to base of oesophagus, at about one-third of body length from the anterior end. Intestine dilated anteriorly to form a bulky cardia, which narrows suddenly into a rather thin intestine. Anus 325μ from the posterior end of body; tail conically attenuated. Vulva in the posterior third of the body, 2.25 mm. from the anterior en Two ovaries, both connected with their respective uteri at about the level of the excretory pore, the uteri running parallel in a posterior direction, uniting a little behind the level of the vulva and giving rise to a single uterus which runs anteriad, coming up to the level of the excretory pore where it is reflexed and runs backwards till it meets the vagina; vagina long, about 500μ in length. Eggs ellipsoidal, 170μ to 190μ long by 100 to 110μ wide, with a thick shell bearing spine-like outgrowths, laid in two-celled

stage and passed out in the form of a chain enclosed in a tubular structure formed most probably by mucous secretio of the oviduct.

Host: Gryllotalpa africana, G. europoeus L. G. vulgaris.

Location: Intestine.

Distribution: U.S.S.R., N. India, Spain.

DISCUSSION

The genus Gryllophila was proposed by the writer in 1942 (8), to accommodate a worm from a mole cricket, which he called G. gryllophila. Sergiev (71) also described a worm from Gryllotalpa from the U.S.S.R., calling it Thelastomum skrjabini. The latter appears to be identica with G. gryllophila and, therefore, the type species of th genus becomes Gryllophila skrjabini (Sergiew, 1923) n. co Serrano Sánchez (72) apparently described the same worm fr another species of Gryllotalpa from Spain and proposed a n genus for it, calling it Neyraiella neyrae. Obviously, sh was in error in observing two spicules in the male. The writer has numerous males of this worm and these have only spicule. Due to this error in observation Serrano Sánchez created a new sub-family, Neyraiellinae, to accommodate th worm; this now becomes a synonym of the family Thelastoma

GENUS CAMERONIA BASIR, 1948

Generic diagnosis:- Thelastomatidae:

Male: Unknown.

Female: With mouth opening circular, surrounded by a circumoral elevation and eight labiopapillae. Buccal cavity short and cylindrical, partly surrounded by the oesophagus and containing one dorsal and two subventral, cuticular elevations. Oesophagus consisting of a corpus, an isthmus, and a posterior bulb. Excretory pore posterior to base of oesophagus. Tail conical. Vulva in the posterior third of the body. Ovaries two; vagina long and muscular, directed anteriorly. Divergent uteri meet near the middle of body to form a single common uterus, which runs backwards to join the vagina. Eggs elliptical, flattened on one side and fused in pairs along their flattened surfaces, slightly asymmetrically but in a constant and regular patterm, externally covered by a common cuticular covering, laid in morula stage, polar filaments absent.

Type Species: Cameronia biovata Basir, 1948 (Fig. 6, K-L).

Specific diagnosis.- Cameronia:

Male: Unknown.

Female: 2.35 to 2.50 mm. long by 400µ in maximum width.

Cuticle striated throughout the body except the tail. Fi annule 15μ wide, annules in the cervical region about 7μ towards the middle of the body they increase in width, re ing a maximum width of 15μ. Mouth opening surrounded by circumoral elevation and eight submedian labiopapillae. Buccal Cavity short and cylindrical, partly surrounded by the oesophagus, 10μ deep by 10μ wide, and containing one dorsal and two subventral cuticular elevations. Oesophag 440μ to 465μ long, consisting of a corpus 317 to 335μ lon by 45μ wide, an isthmus 20μ long by 40μ wide, and posteri valvular bulb 125 to 150μ long by 230 μ wide, and a Nerve ring 200μ from the anterior end of body. Excretory pore posterior to base of oesophagus, 500μ from the anterior extremity. Intestine enlarged anteriorly to form a cardi Anus 180 to 190u from the posterior end of body. Tail co cal. Vulva 1.7 mm., about 72% of the body length from the anterior end. Ovaries two, vagina long and muscular, meeti a common uterus that runs anteriorly up to the middle of then branches into two divergent uteri. Eggs elliptical, flattened on one side and fused in pairs along their flattened surfaces with a slight asymmetry, one-fifth of length of each egg projecting free on opposite sides; each pair secondarily covered over by a common cuticular layer 130u in length by 50u in width, and are laid in morula st

Host: *Gryllotalpa africana* Beauv.

Location: Intestine (rectum).

Type Locality: Aligarh, North India.

GENUS AORURUS LEIDY, 1849

Synonym: Aorurus (Streptostoma) Leidy, 1849.

Generic diagnosis: Thelastomatidae: Oral opening surrounded by an external circle of eight equal labiopapillae or papillae. Amphids present at level of external circle of papillae. Buccal cavity very short and wide. Oesophagus with short, thick corpus in female, forming a pear-shaped swelling; isthmus short or long. Excretory pore near base of oesophagus or posterior to it. Tail of male filiform. Genital papillae consisting of two pairs of papillae just anterior to anus, one pair of these more or less fused; one pair of partially fused postanal papillae, just posterior to anus, and one pair on tail. Spicule absent. Testis reflexed. Tail of female filiform (more spine-like). Vulva either near middle of body or near anus; vagina directed anteriorly, uteri divergent, ovaries reflexed. Eggs ellipsoidal.

Type Species: Aorurus agile (Leidy, 1849) Baylis and Daubney, 1926 (Fig. 6, M-R).

Synonyms: Aorurus subcloatus Christie, 1931
Aorurus (Streptostoma) agile Leidy, 1849.
Streptosomum agile Leidy, 1853.
A. (Streptostoma) agilis Walton, 1927.

Specific diagnosis: Aorurus:

Male: Body moderately slender, 0.84 to 1.1 mm. long, coarsely annulated; annules 5μ wide back of head cap, increasing to 6 or 8μ in middle of body. Narrow alae present, 6μ wide in middle of body. Amphids present. Head papillae not observed. Mouth sub-triangular. Head annule 50μ wide. Buccal cavity 8μ deep by 6μ in average width. Oesophagus divided into a corpus which does not form a pseudobulb, an isthmus 24μ long by 12 to 14μ wide, and a valvular bulb slightly longer than broad. Intestine somewhat dilated anteriorly. Excretory pore slightly posterior to base of oesophagus. Nerve ring at the anterior end of the isthmus. Caudal spike 0.15 to 0.18 mm. long. Anus located on an elevation and surrounded by five circum-anal papillae; a median pair of preanal papillae, more or less joined at their base, and in many cases appearing one behind the other; a pair of more widely spearated, somewhat preanal papillae on the side of the anal prominence; a median postanal double papillae and another pair of postanal papillae about three-fifths the distance from the anus to the tip of the tail.

Female: 2.3 to 2.5 mm. long, coarsely annulated; annules 10μ apart back of head region, increasing to 20μ at middle of body. Narrow alae present. Head short, more or less truncate. Mouth circular to subtriangular, surrounded by eight papillae. Amphids present. Buccal cavity 5μ

deep by 9μ wide, unarmed. Oesophagus 220μ long, its anterior portion enlarged into a distinct, pyriform median bulb, 70μ wide, the entire corpus entering into the formation of the corporeal swelling, there being no distinguishable differentiation between anterior and posterior parts of corpus a short and distinct isthmus and a posterior valvular bulb of the same width as the pseudobulb. Anterior end of intestine dilated to form a cardia. Tail filiform, caudal spike 1 to 1.2 mm. long. Nerve ring encircles the neck of the median bulb. Excretory pore slightly anterior to base of oesophagus. Vulva slightly salient, 80μ anterior to anus. Vagina directed anteriorly, mostly muscular, extending to about one-third the distance between anus to head, where it branches to form the two divergent uteri. Eggs ellipsoidal, 90μ long by 60μ broad, deposited before segmentation begins.

Host: Larva of Osmoderma (O.Scabra Beauv.?) Spirobolus marginatus (millepede).

Location: Intestine.

Distribution: United States of America.

2. Aorurus philippinensis Chitwood and Chitwood, 1933. (Fig. 6, S-U)

Specific diagnosis: Aorurus:

Male: Unknown.

Female: 4 to 4.5 mm. long by 165 to 270μ in maximum width. Cuticle both annulated and striated. Head

distinctly set off by a deep annulation followed by a long, modified first annule of body, posterior to which the cutic is coarsely annulated and inflated; annules 17 to 35μ wide; each annule finely striated, striae 2 to 5μ apart; annules gradually becoming less distinct in mid-region of body. Oral opening hexangular, apices of angles submedian and lat rather than median and sublateral. Cephalic papillae apparently consisting of an internal circle of six rudiment papillae and an external circle of eight well-developed simple papillae. Oesophagus 473 to 540μ long, consisting of a pear-shaped corpus, 160μ long with a minimum diameter 56 to 60μ and a maximum diameter of 84 to 110μ; a narrow isthmus 216 to 260μ long by 35 to 40μ wide; and a bulb 130μ long by 120 to 124μ wide. Nerve ring posterior to base of corpus. Excretory pore 840μ from anterior end of body. Intestine dilated at base of oesophagus. Anus 735 to 800μ from posterior end of body. Tail filiform (spicate). Phasmic approximately one-half of the body diameter posterior to anu Vulva 1.82 to 2.18 mm. from anterior end of body; prominent; anterior lip projected posteriorly; true vagina 150 to 160μ long, lined with cuticle; uterine vagina about 250μ long; uteri divergent; anterior ovary directed posteriorly and reflexed anteriorly, posterior ovary directed anteriorly and reflexed posteriorly. Eggs ellipsoidal, 164 to 166μ long by 70 to 80μ wide.

Host: Panesthia javanica.

Location: Presumably intestine.

Distribution: Philippine Islands.

Key to the species of the genus Aorurus

1. Corpus of female about one-third total length of oesophagus; vulva near middle of body..... A. agile.

2. Corpus of female about one-half total length of oesophagus; vulva just anterior to anus..... A. philippinensis.

DISCUSSION

The genus Aorurus was proposed originally by Leidy (51) to accommodate two species, A. (Streptostoma) agile Leidy 1849 and A. (Thelastoma) attenuatum Leidy, 1849. In 1853 these subgenera were raised to generic rank by the same author (55) and the name Aorurus was suppressed. The present species was then named Streptostomum agile. In 1927, Walton (89) revived the genus Aorurus with its two previous sub-genera and made this species the type species of the subgenus Streptostoma calling it A. (Streptostoma) agilis. In 1929, Travassos (86) placed Blattophila sphaerolaima Cobb, 1920 in the genus Aorurus, the former being recognised as a separate genus by Chitwood and Chitwood (21). A.diesingi (Ham., 1838), Trav., 1929, was made the type of a new genus by Chitwood (20). A. subcloatus Christie, 1931 was regarded as a synonym to

A. agile Leidy by Chitwood (20). This left a single species in this genus. Later, Chitwood and Chitwood (21) added another species to it, namely, *A. philippinensis.*

LEGENDS

Fiure 6

(A-J) *Gryllophila skrjabini*

A. Female, entire.
B. Female, *en face* view.
C. Female, head end, magnified.
D. Female, reproductive organs, diagrammatic.
E. Egg.
F. A chain of eggs as laid.
G. Male, entire.
H. Male, oesophageal region.
I. Male, tail, lateral view.
J. Male tail, ventral view.

(K-L) *Cameronia biovata*

K. Female, entire.
L. Eggs.

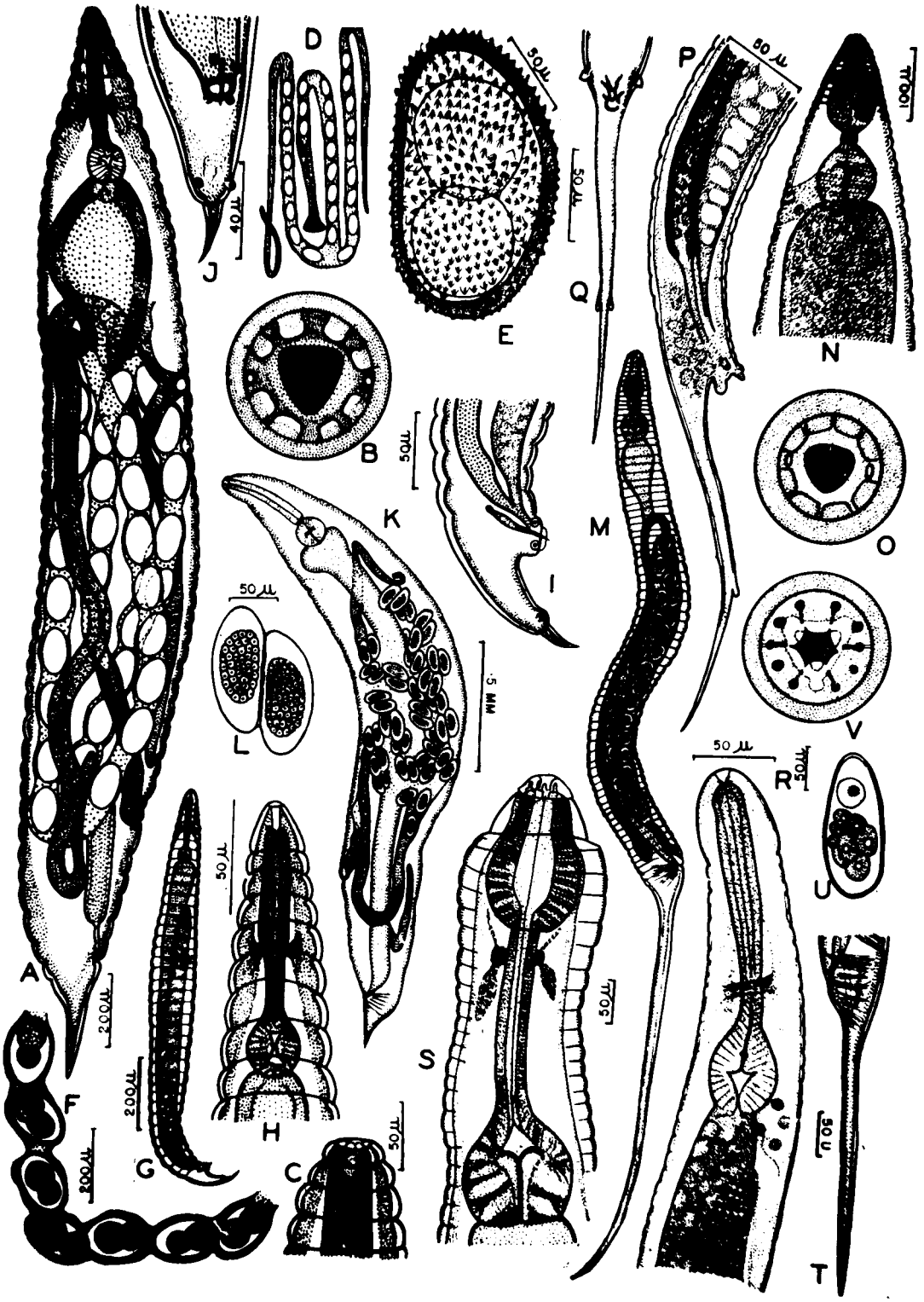
(M-R) *Aorurus agile*.

M. Female, entire.
N. Female, anterior region.
O. Female, *en face* view.
P. Male tail, lateral view.
Q. Male tail, ventral view.
R. Male, anterior region.

(S-U) *Aorurus philippinensis*.

S. Female, anterior region.
T. Female, tail.
U. Egg.

(M. after Leidy (55); N-R after Christie (27); S-U. after Chitwood and Chitwood (21). Remainder original.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50 µ
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.5 MM

GENUS HAMMERSCHMIDTIELLA CHITWOOD, 1932

Generic diagnosis: Thelastomatidae: Mouth surround by eight submedian labiopapillae. Amphids present. Mouth capsule prismoidal, guarded at the base by three toothlik projections. Oesophagus consisting of an anterior corpus a distinct isthmus, and a posterior valvular bulb. In th female the posterior part of corpus forms a distinct swel in the form of a pseudobulb. This swelling is not as prominent in the male. Excretory pore posterior to base oesophagus. Intestine not provided with a caecum, but dilated to form a cardia. Tail long and filiform in fema Vulva in anterior third of body; vagina directed obliquel posteriorly, communicating with a common sac-like uterus which extends into the anal region of the body, where it connected with the two oviducts. Ovaries two, both anter lying coiled in the region of the vulva. Both extend post iorly to behind the middle of body where they open into th oviducts; these reflex and are directed anteriorly but tu again, and run posteriorly till they reach the posterior of the uterus into which they open from the posterior sid Tail of male filiform and sharply set off. One pair of preanal papillae and one pair of postanal papillae on tru ted part of body; a single ventral papilla on the tail close to its origin. One spicule.

Type Species: Hammerschmidtiella diesingi (Hammerschmidt, 1838).

Hammerschmidtiella diesingi (Hammerschmidt, 1838) Chitwoo (1932). (Fig. 7, A-C).

Synonyms: Oxyuris diesingi Hammerschmidt, 1838.

Oxyuris blattae orientalis Hammerschmidt, 18

Strptostomum gracile Leidy, 1850.

Anguillula macrura Diesing, 1851.

Aorurus diesingi (Hammerschmidt, 1838), Travassos, 1929.

Aorurus (Streptostoma) Diesingi (Ham., 1838) Walton, 1927.

Aorurus (Streptostoma) blattae-orientalis (Ham., 1847), Walton, 1927

Specific diagnosis: Hammerschmidtiella:

Male: 820 to 870μ long by 52 to 64μ wide. Oesophagus 126 to 190μ long, consisting of an anterior cylindrical p 60 to 85μ long by 18 to 28μ wide, distinctly set off from the rather long isthmus which merges imperceptibly into t bulb. Nerve ring situated 70 to 90μ and excretory pore 20 to 330μ from anterior end of body. Intestine simple; anu 80 to 95μ from posterior end of body. Tail distinctly se off; seta-like caudal papillae consist of one pair of pre near the anus, one pair preanal or adanal situated more l erally, and a single unpaired ventral papilla near base o tail. One spicule, 20 to 25μ long.

Female: 2.2 to 3 mm. long by 134 to 225μ wide. Cuticle coarsely annulated, annules 14 to 20μ wide near t head. Oesophagus 260 to 320μ long, the anterior part of which is 180 to 230μ long and is subdivided into an anteri

cylindrical part 100 to 140μ long by 20 to 30μ wide; and a posterior, elongate, somewhat ovoid pseudobulb 80 to 90μ long by 56 to 60μ wide. Isthmus distinctly set off, 30 to 3 long by 16 to 20μ wide; bulb pyriform, 60 to 70μ wide. Nerve ring situated anterior to pseudobulb, 80μ from anteric end of body; excretory pore posterior to base of oesophagus, 340 to 450μ from anterior end of body. Intestine enlarged, anteriorly to form a cardia; anus 620 to 920μ from posterior end of body. Tail filiform, highly variable in length. Vulva 520 to 580μ from anterior end of body at about 22 to 26% of the body length. Vagina long, directed obliquely posteriorly, opening into a common saclike uterus which extends posteriorly, in certain cases into the anal region. ovaries two, both anterior, lying coiled in the region of the vagina; both extend posteriorly to about two-thirds of the body where they communicate with the oviducts which run anteriorly about half way to the vulva, where they are reflexed and run backwards until they join the uterus at its posterior extremity. Eggs 76 to 80μ long by 30 to 32μ wide.

Host: Blatta orientalis Linn., and Periplaneta americana Linn.

Location: Rectum.

Distribution: Europe, North America, South America, North India and Russia.

Life-History: Similar to that of Leidynema appendiculatum. Eggs do not hatch outside the body of the host. They are not infective until they reach the resting embryonated stage. Infection takes place by ingestion of eggs by the host. Eggs hatch in the hind gut. The youngest larvae, measuring 150 to 170μ in length, cannot be distinguished from the larvae of L. appendiculata of the same size. However, in slightly older larvae, measuring about 208μ in length the typical oesophageal pseudobulb begins to appear. According to Todd (81), one moult takes place outside the body of the host before reaching the infective stage and the other, after ingestion of the eggs but before hatching. Only two moults have been observed in the life history of this worm.

Hammerschmidtiella nayrae Serrano-Sánchez, 1947.

Specific diagnosis: Hammerschmidtiella:

Male: 1.27 mm. long by 80μ wide. Cuticle striated. Oesophagus 146μ long, composed of a corpus which bears a pyriform pseudobulb; an isthmus, and a posterior valvular bulb. Corpus subdivided into an anterior cylindrical part, 23μ long, and a posterior pyriform pseudobulb, 35μ long by 15μ wide; isthmus 50μ long and the posterior bulb 25μ long by 25μ wide. Anus 34μ from the posterior end of body, bearing one pair of preanal, one medio-ventral and one pair of postanal papillae. Spicule, single, 28μ long.

Female: 2.8 mm. long by 285µ wide. Cuticle striated. Mouth opening subtriangular, surrounded by eigh labiopapillae. Oesophagus 333µ long. Corpus with an anterior cylindrical portion 120µ long and a pseudobulb 98 long by 56µ wide; isthmus 60µ long and the posterior valvu bulb 55µ long by 70µ wide. Anus 400µ from the caudal extr ty. Tail filiform forming about one-seventh of the total b length. Nerve ring 80µ and excretory pore 525µ from the anterior end of the body. Two ovaries; (?) uteri amphi-delphic. Vulva 900µ from the anterior end of body. Eggs 78µ long by 34µ wide.

Host: Periplaneta americana L.

Location: Intestine.

Distribution: Spain.

Key to the species of the genus Hamerschmidtiella.

1. Tail of female forming about one-seventh of the total body length.....H. nayrae

2. Tail of female much longer, forming about one-fourth and one-half of the total body length..... H. diesingi.

DISCUSSION

The genus Hamerschmidtiella was proposed by Chitwood (20) to accommodate Oxyuris diesingi Hamerschmidt, 1338, O. blattae-orientalis Ham., 1847, as described and drawn b its author, is a redescription of O. diesingi, and therefo

becomes a synonym of H.diesingi. The same species was described by Leidy (52) as Streptostomum gracile and by Diesing (36) as Anguillula macrura. Walton (89) revived the genus Aorurus Leidy, 1849, with its two sub-genera Streptostoma and Thelastoma and placed both the original species of Hammerschmidt in the sub-genus Streptostoma, referring to them as A. (Streptostoma) diesingi and A. (Streptostoma) blattae-orientalis. Travassos (86) suppressed the sub-genus Streptostoma and recognized both the original species of Hammerschmidt, placing one of them in the genus Aorurus as A. diesingi and the other in a new genus, Leidynema proposed by Schwenk (in Travassos (86), calling it L. blattae-orientalis. All these names now become synonyms of H.diesingi. Serrano Sánchez (72) added another species to this genus from Spain. Her species differs from the type species only in the length of the tail.

The females of the genus Aorurus differ from those of Hammerschmidtiella mainly in the formation of their corporeal swelling and in the position of the vulva. In the former, the entire corpus forms the pseudobulb so that the anterior and posterior parts of the corpus cannot be differentiated and the vulva lies either in the middle or in the posterior part of the body; in the latter genus only the posterior part of the corpus forms the pseudobulb and, therefore, the anterior and posterior parts of the corpus are differentiated easily, and the vulva lies in the anterior third of the body.

GENUS BLATTOPHILA COBB, 1920

Generic diagnosis: Thelastomatinae: Oral opening surrounded by eight labiopapillae; amphids open at level of labiopapillae. Lateral alae absent. Buccal cavity short and wide, partially surrounded by anterior end of oesophagus and having at its base six cuticular thickenings serving as points of attachment for muscles. Oesophagus consists of a clavate corpus distinctly enlarged at anterio end in form of a subspherical swelling with a posterior par swollen slightly but not set off, a short, narrow isthmus, and a bulb. Excretory pore posterior to base of oesophagus Intestine dilated at anterior end; caecum absent. Tail of male truncate, conical, bearing two large preanal submedian papillae adjoining anus, and two similar postanal papillae, one-third of body diameter, posterior to anus. Spicule represented by a rudimentary point. Tail of female filifor and spine-like. Vulva anterior to middle of body. Eggs ellipsoidal.

Type Species: Blattophila sphaerolaima Cobb, 1920.

1. Blattophila sphaerolaima Cobb, 1920.

Specific diagnosis: Blattophila:

Male: 2.52 mm. long by 135µ wide. Oesophagus 275µ long. Nerve ring 192µ from anterior end of body. Excretor

pore posterior to base of oesophagus. Intestine simple; anus 450μ from posterior end of body. Tail truncate, conica bearing two large preanal submedian papillae adjoining the a and two similar postanal papillae one-third of body diameter posterior to the anus. Spicule (? two) represented by a rudimentary point.

Female: 3.3 mm. long by 300μ wide. Cuticular striae 3μ wide near the head, 24μ wide in the body region. Mouth surrounded by very small lips (?) forming an annular elevat Amphids and setae absent (?). Mouth cavity and apophyses dominating. Oesophagus 462μ long; anterior three-fourths clavate and one-third as wide as corresponding body diameter followed by a short, narrow isthmus and an oblate posterior bulb. Nerve ring 297μ from anterior end of body. Excretor pore posterior to base of oesophagus. Intestine simple; anus 760μ from posterior end of body. Tail acute conoidal, filiform? Vulva anterior to middle of body; 924μ (28% of the body length) from anterior end of body; two ovaries directed posteriorly, reflexed. Eggs 88 to 104μ long by 40 to 48μ wide, segmented at deposition.

Host: Panesthia brevicollis? (probably P. laevicollis Gauss

Location: Intestine.

Distribution: Moss Vale, New South Wales, Australia.

2. Blattophila sphaerolaima var. Javanica Chitwood and Chitwood, 1933

Specific diagnosis: Blattophila:

Male: Unknown.

Female: (Non-gravid) 2.5 to 2.63 mm. long by 250 to 273µ in maximum width. Cuticle coarsely annulated; annules 8 to 10µ wide near head and 26 to 28µ wide at midregion of body. Buccal cavity short, sub-triangular in cross section enclosed in anterior end of oesophagus and provided with tw sub-dorsal and four sub-ventral cuticular thickenings at ba (presumabely the "apophyses" of Cobb). Oesophagus 410 to 610µ long; cephalic swelling of oesophagus 33 to 50µ long b 35 to 44µ wide, corpus 280 to 360µ long with a minimum diam of 34 to 40µ and a maximum diameter of 56 to 70µ; isthmus 3 to 40u long by 28 to 30u wide; bulb 100 to 120u long by 80 97µ wide. Nerve ring not observed. Excretory pore immediat posterior to base of oesophagus. Intestine thick-walled wi a short dilated part, posterior to oesophageal bulb. Anus 590 to 670µ from posterior end of body. Phasmids slightly posterior to anus. Tail filiform, spicate. Vulva 550 to 750µ from anterior end of body, 21 to 23.6% of body length from anterior end. Vagina directed posteriorly, true vagin (cuticularly lined) approximately 130µ long; origin of uter uncertain; two ovaries directed posteriorly, reflexed. Eggs not observed.

Host: ———————— Panesthia javanica

Location: Presumably intestine.

Distribution: Philippine Islands.

Key to varieties of Blattophila sphaerolaima

1. Vulva 28% of body length from anterior end, annulations 3μ apart in anterior body and 24μ apart in middle of body .... Blattophila sphaerolaima

2. Vulva 21 to 23.6% of body length from anterior end, annulations 8 to 10μ apart in anterior body and 26 to 28μ apart in middle of body..... Blattophila sphaerolaima var. javanica

3. Blattophila supellaima Basir, 1941.

Male: Unknown.

Female: 2.5 mm. long by 360μ wide. Cuticle annulate annules about 10μ wide near the head and 15 to 20μ wide near the middle of body. Buccal cavity short and wide, partially surrounded by the anterior end of the oesophagus, 10μ deep by 20μ wide. Oesophagus 387μ long; cephalic swelling of oesopha 15μ long by 20μ wide, corpus 262μ long with a minimum diameter of 17μ and a maximum diameter of 40μ, which represents the posterior swelling; isthmus 40μ long by 27μ wide; bulb 85μ lor by 90μ wide. Nerve ring 175μ from the anterior end of body. Intestine thick-walled with a distinct dilated cardia. Anus from posterior end of body. Tail filiform, spicate. Vulva 1.0 mm. from anterior end of body, about 41% of the body length from the anterior end. Ovaries two, both anterior, directed

posteriorly and reflexed anteriorly. Vagina directed anteriorly, true vagina cuticularly lined, about 100µ long communicating with the single uterus which runs straight backwards to a length of about 700u where it meets the two oviducts, one of which is directed anteriorly while the ot is directed posteriorly for about 100µ, then is reflexed a runs anteriad parallel to the first oviduct. Both the oviducts meet the ovaries at about one third of the body length from the anterior end. The ovaries are reflexed at about 270µ posterior to base of oesophagus, and directe posteriorly. They originate somewhere near the origin of the vulva. Eggs ellipsoidal, 80µ long by 60µ wide.

Host: Supella supellectillum Serv.

Location: Intestine (rectum).

Distribution: Ali arh (North India).

Key to the species of the genus Blattophila Cobb,

1. Vulva 21 to 28% of body length from anterior end, vagina directed posteriorly, tail 23.6% of body length.....B.sphaerolaima.

2. Vulva 41% of body length from anterior end, vagina directed anteriorly, tail 15.2% of body length B.Supellaima.

DISCUSSION

Travassos (86) placed Blattophila sphaerolaima Cobb, 1920 in the genus Aorurus. Chitwood (20) removed it from this genus due to the difference in the structure

the genus, and placed it in a genus of [illegible] [illegible] in the sub-family Phalaenopsidae. Garayan, Pabona and Tiburcio (11) recognized the genus when they described a new variety (D. schoenleinae var. luzonica) of Doritis pulcherrima, a Philippine coelogyne. Rusin (7) called another species from Manila, D. micholitzii, which he named D. pulcherrima.

GENUS LEIDYNEMELLA CHITWOOD AND CHITWOOD, 1933

Generic diagnosis: Thelastomatinae: Male unknown in type species. In known species, one testis, reflexed, tail very abruptly set off from remainder of body, appear as a dorsal appendage. Single spicule. Caudal papillae consisting of one pair of preanal papillae, one medio-ven postanal papilla, and a pair of subdorsal postanal papill all near anus. Female with narrow lateral alae; cuticular annulations small but conspicuous. Oral opening surrounde by eight submedian labiopapillae; amphids lateral, small. Buccal cavity short, prismoidal. Oesophagus consisting of a long narrow corpus terminated by a subspherical swelling a disntinctly set off isthmus, and a bulb. Nerve ring apparently surrounding middle of corpus. Excretory pore n observed. Intestine dilated anteriorly then becoming nar diverticula absent. Tail filiform. Vulva approximately half way from head to anus; vagina directed posteriorly; uteri apparently divergent. Eggs not observed.

Type species: Leidynemma paracranifer Chitwood and Chitwood, 1933.

1. Leidynemella paracranifera Chitwood and Chitwood, 1933 (Fig. 7, I-J).

Specific diagnosis: Leidynemella:

Male: Unknown.

Female: (Non-gravid) 1.6 mm. long by 120μ wide. Lateral alae not terminated posteriorly by spines. Cutic annules 10μ wide in mid region of body; head set off as t modified annules; oral opening surrounded by eight subme labiopapillae. Buccal cavity prismoidal, bearing cuticu thickenings near base. Oesophagus 226μ long; anterior part of corpus 130μ long by 60μ wide, posterior part 30μ long by 28μ wide; isthmus 30μ long by 12μ wide; bulb 36u long by 32u wide. Nerve ring apparently 100μ from anteri end of body. Anus 630μ from posterior end of body. Vul 450μ from anterior extremity.

Host: Panesthia javanica.

Location: Presumably intestine.

Distribution: Philippine Islands.

2. Leidynemella fusiformis Cobb, in Chitwood and Chitwoo 1933.

Specific diagnosis: Leidynemella:

Male: More slender and less fusiform than female. Oesophagus not described, presumably as in female. Tail s off from body by abrupt diminution in size, almost as attached as an appendage to the dorsal side of a terminal anus; only two to five times as long as neck but like that a female, is slender and pointed. Caudal papillae consist of two subventral preanal papillae, one medio-ventral post

papilla, and two subdorsal papillae, all near anus. Testis extending one-half distance from anus to base of oesophagus, reflexed. Spicule straight, linear, equal to anal body diameter in length. Caudal alae absent.

Female: 1.5 mm. long by 106μ wide. Body striated, striae plain, transverse, giving contour of worm a crenate appearance, changing somewhat in cervical region, 3 to 5μ apart near middle of body. Neck conoid, with two prominent lateral retrorse spines, situated between 115 to 140μ from anterior end of body. Lateral alae terminated posteriorly by paired lateral spines opposite anus. Head varying in appearance, somewhat truncate, generally appearing as swollen forming a crown. Cephalic papillae and amphids not observed. Buccal cavity about 10μ deep by about 6μ wide. Oesophagus 232μ long, with a corpus which is subdivided into an anterior cylindrical part and a posterior valvulated bulb 52μ wide, an isthmus one-fifth to one-fourth as wide as the corresponding part of the neck and somewhat longer than the following cardiac bulb. Nerve ring 165μ from anterior end of body. Excretory pore not observed. Intestine dilated at anterior end. Anus 645μ from posterior end of body. Tail filiform. Vulva 305μ from anterior end of body; vagina directed anteriorly, reflexed posteriorly; uteri extending backwards to vicinity of anus, then reflexed. Ovaries about 750μ long, their blind ends lying near vulva. Eggs thin-shelled, 90 to 100μ long by 36μ wide, slightly curved, segmented, approximately 12 in number.

Host: Panesthia Laevicollis (?)

Location: Intestine.

Type locality: New South Wales, Australia.

3. Leidynemella panesthiae (Galeb, 1878), Chitwood and Chitwood, 1933. (Fig. 7, K-M).

Synonyms: Oxyuris panestiae Galeb, 1878 (in part).

Thelastoma panesthiae (Galeb, 1878) Travassos, 1929, Chitwood, 1932.

Specific diagnosis: Leidynemella:

Male: (?) I mm. long, somewhat similar to Hammerschmidtiella diesingi.

Female: 2 mm. long, mouth trilobed, cuticle inflated at the first annule; oesophagus consisting of an anterior corpus forming a bulb in its posterior part, a long isthmus and a posterior cardiac bulb. Nerve ring situated just anterior to the corporeal bulb. Tail long and filiform. Vulva posterior to middle of body, approximately 66% of the body length from the anterior end. Ovaries two; uteri presumably divergent.

Host: Panesthia sp.

Location: Presumably intestine.

Distribution: New Guinea.

Discussion

Galeb (44) described this species as Oxyuris

panesthiae. He gives two figures of th female, one of an entire worm and the other of its anter end. The two figures are totally different from each In the former one, he does not show an oesophageal bulb, while in the latter, the pseudobulb is figured clea Chitwood (20) placed this species as a species inquire in the genus Thelastoma, and later, Chitwood and Chitwood (21) transferred it to the genus Leidynemella. Galeb (44) in his description, stated that the oesophagus might or might not have an anterior pseudobulb. He claimed to have ample material for his study (about 40 specimens). Chitwoo and Chitwood (21) suggested that it might have been pos ib that Galeb was dealing with a young female in which the pseudobulb had not yet developed. However, observation of his figure of the entire worm shows that it has reached a stage far ahead of that when, at least in this group of worms, the oesophageal structure assumes adult form. Dobrovolny and Ackert (39) stated that in Hamerschmidtiella diesingi larvae, measuring only about 208μ in leng and with their reproductive organs still in the form of a genital primordium, and hence undeveloped , the oesophageal pseudobulb begins to be differentiated. The writer, therefo suspects that Galeb may have been studying two different species, which he described as one, probably because the o marked differenc

betwenn the two was in the structure of the oesophagus, and, in the absence of other evidence, he placed this spedies promisionally in the genus Leidynemella, leaving clarificat to future workers with fresh material from the same host.

4. Leidynemella socialis (Leidy, 1850) n. comb.

Synonyms: Oxyuris socialis Leidy, 1850.

Anguillula socialis (Leidy, 1850), Leidy, 1856.

Thelastoma socialis (Leidy, 1850), Travassc 1929.

Specific diagnosis: Leidynemella:

Male: 1.693 to 1.27 mm. long by 63.5μ wide. Anus 191μ from posterior end of body. Tail curved and pointed. forming about one-eighth of the body length, and bearing "fiv minute epidermal prominences (papillae) on the inner side." One spicule, curved, 63.5μ long.

Female: 2.117 to 4.656 mm. long by 95μ wide. Buccal cavity short. Oesophageal corpus long and cylindrical, dilate at the posterior part, 385μ long by 32μ wide; bulb narrow, pyriform, 127μ long by 38μ wide. Anus 445μ from the posterior extremity; tail filiform forming less than one-fifth of the body length. Vulva slightly anterior to middle of body, salient. Eggs ellipsoidal, 69μ long by 38μ wide.

Host: "Acheta abbreviata" (Black cricket).

Location: Large intestine.

Distribution: United States of America.

Leidy (52) described this species as Oxyuris socialis but his description was unaccompanied by diagra Later, he (56) transferred this species to the genus Anguillula. He did not redescribe it in his subsequent papers, nor did he associate it with either Thelastoma or Streptostoma, the two genera in which he had placed most of his species from arthropods. The present writer thinks it was placed in the genus Anguillula because of the structure of the oesophagus which closely resembles that of Anguillula as, according to Leidy, it has a dilatation at the posterior part of the corpus. Later authors seem almost to have ignored this species. Walton (39), in his revision of the nematodes of Leidy's collection, did not mention it. Travassos (36) referred it to the genus Thelastoma, but there is no further mention of it in the literature. The present writer, after careful consideration is of the opinion that this species should be in the genus Leidynemella, where not only the females but also the male as described by Leidy, could be accommodated. The number of caudal papillae given for the male of L. fusiformis agr with the number given by Leidy for O. socialis. Other characters are also very similar.

However, it should be noted that until now, there is only one nematode, namely, Cephalobium microbivorum Cobb, 1920, the adults of which have been found to parasit a cricket. This nematode is now placed in the family Diplogasteridae. It resembles closely a Thelastomatid worm in its general characters but its buccal cavity is very different and it is felt that a worker such as Leidy could not have ignored such obvious structures as distingui the genus Cephalobium from the Thelastomatids.

Key to the species of the genus Leidynemella

1. Vulva anterior to or near middle of body 2
   Vulva much posterior to middle of body.....
   L.Panesthiae.

2. Tail of female long, forming more than one-third of body length..... 3
   Tail of female comparatively short, forming much less than one-third of body length.....
   L. socialis.

3. Lateral alae of female terminating in spinate processes; cuticular annules not over 5μ long--
   L. fusiformis.
   Lateral alae of female not terminating in spinate processes; cuticular annules 10μ long near middle of body.....L. paracranifera.

DISCUSSION

The genus Leidynemella was proposed by Chitwood and Chitwood (21) to accommodate two new species which were characterized by the possession of a subspherical swelling at the base of the corpus. They distinguished this genus from Leidynema, to which it appears to be related closely, by the difference in the form of the corporeal swelling which is sub-cylindrical in the latter genus. They also placed Oxyuris panesthiae Galeb, 1878 in this genus, a species which had previously been placed in the genus Thelastoma as a species inquirenda by Chitwood (30). The present author now places into it, Oxyuris socialis, a species described by Leidy (52) from a cricket.

LEGENDS

Figure 7

(A-C) Hammerschmidtiella diesingi

A. Female, entire.
B. Female, en face view.
C. Male, entire.

(D-F) Blattophila sphaerolaima var. javanica

D. Female, en face view.
E. Female, oesophageal region.
F. Female, tail.

(G-H) B.superllaima.

G. Female, entire.
H. Egg.

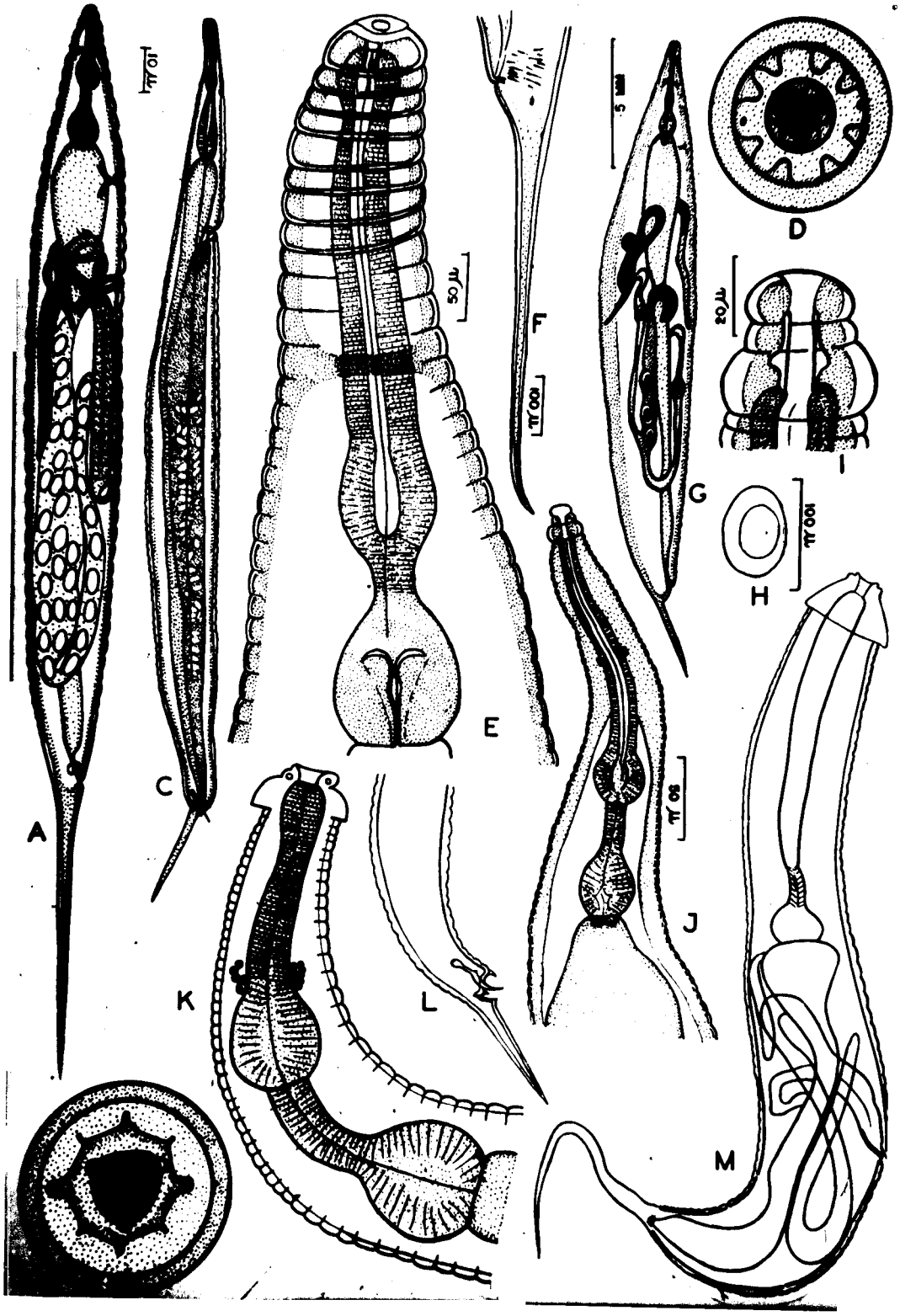
(I-J) Leidynemella paracranifera.

I. Female, head region, highly magnified.
J. Female, oesophageal region.

(K-M) L.panesthiae.

K. Female, oesophageal region.
L. Male, tail, lateral view.
M. Female, entire.

(B,C after Chitwood (20); D-F, I-J after Chitwood and Chitwood (21); K-M after Caleb (44). Remainder original).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GENUS LEIDYNEMA SCHWENK (in Travassos, 1929)

Synonym: Thelastoma (in part).

Generic diagnosis: Thelastomatidae: Mouth surrounded by very large submedian labiopapillae; amphids or lateral or appe ring externally as small circular openings. Oesophagus of female consisting of an anterior part which is subdivided into two cylindrical parts of which the posterior is somewha larger in diameter than the anterior, a distinct isthmus, and a valvular bulb. Excretory pore posterior to base of oesophagus. Intestine may or may not be enlarged anteriorly to form a cardia; a posteriorly directed caecum may or may not be present; the intestine may have a loop in the posteri part of the body. Vulva near middle of body; amphidelphic. Eggs ellipsoidal. Oesophagus of male without distinct poster ior swelling in anterior part of oesophagus. Tail of female attenuated or filiform. Tail of male short, rounded, with a minute mucron or filiform. One pair of large preanal caudal papillae, two pairs of postanal papillae. One spicule.

Type species: Leidynema appendiculata (Leidy,185) Chitwood,1932.

1. Leidynema appendiculata (Leidy, 1850) Chitwood, 1932. (Fig. 8, A-I).

Synonyms: Aorurus (Thelastoma) appendiculatum Leidy, 185

Thelastomum appendiculatum Leidy, 1853.

Oxyuris blattae Hammerschmidt, 1847, of Galeb 1878.

Oxyuris blattae orientalis Hammerschmidt, 1847, of Bütschli, 1878.
Oxyuris blattae-orientalis Hammerschmidt, 1847, of Magalhães, 1900.
Aorurus (Thelastoma) appendiculatus (Leidy, 1850) Walton 1927.

Leidynema blattae.orientalis (Hammerschmidt, 1847) of Schwenk, in Travassos, 1929.
Leidynema appendiculata var. americana Serrano Sánchez, 1947

L. appendiculata var. hispana Serrano Sánchez, 1947.

L. appendiculata var. indiana Serrano Sanchez, 1947.

Specific diagnosis: Leidynema:

Male: 525 to 830μ long by 45 to 87μ wide; cuticle striated, striations more prominent near the anterior end, 3 apart. Oesophagus 133 to 216μ long; anterior part 30 to 166μ long by 8 to 20μ wide; isthmus 17 to 30μ long by 9 to 12μ wi not distinctly set off; bulb 34 to 40μ long by 20 to 36μ wid Nerve ring 75 to 155μ from anterior end of body. Excretory pore 200 to 320μ from anterior end of body. Intestine simple without a diverticulum or a loop, anus 10 to 20μ from poster end of body. Tail much attentuated and very small, provided with one pair of large sub-ventral preanal papillae, one pai

of subventral postanal papillae, and one pair of small, indistinct, subdorsal papillae. One spicule, 26 to 35μ long.

Female: 1.9 to 4.025 mm long by 140 to 350μ wide. Cuticle closely annulated throughout the length of body. Lateral alae prominent, each ala terminating posteriorly in a spine-like projection. Mouth surrounded by eight large submedian labiopapillae. Oesophagus 396 to 497μ long cosisting of an anterior corpus 290 to 330μ long, subdivided into an anterior part 144 to 180μ long by 30 to 36μ wide and a posterior pseudobulb 140 to 148μ long by 30 to 36μ wide, an isthmus 16 to 45μ long by 35 to 40μ wide, set off distinctly from the anterior cylindrical pseudobulb, and a posterior valvular bulb 90 to 106μ long by 100 to 148μ wide. Nerve ring 120 to 195μ from anterior end of body; excretory pore posterior to base of oesophagus, 460 to 600μ from anterior end of body. Anterior part of intestine greatly enlarged, provided with a posterior caecum or diverticulum; posterior part of directed intestinal ~~greatly enlarged, provided with a~~ intestine forming a loop in mature specimens. Anus 420 to 826μ from posterior end of body. Tail filiform. Vulva slightly posterior to middle of body, 105 to 1.935 mm. from anterior end. Ovaries two, amphidelphic. Eggs oval, elongate and flattened slightly on one side, 100 to 112μ long by 45 to 53μ wide, segmented when deposited.

Host: Blatta orientalis Linn., Periplaneta americana Li and Blaberus atropos Stoll.

Location: Large intestine.

Distribution: North America, South America, Europe, China, and U.S.S.R.

Life cycle: Eggs of L. appendiculata do not hatch outside the body of the host. Eggs when exposed to direct strong artificial or natural light for 15 minutes fail to develop#. They remain viable for a considerable time if kept moist at room temperature and away from sunlight. Eggs in uteri are usually unsegmented. At the time of extrusion they are undeveloped or rarely in the two to four-celled stages. The morula with small blastomeres is followed by stages a period of embryonic growth. The first flattened embryo after the morula has a tail bud at the posterior extremit Growth occurs both anteriorly and posteriorly until a motile tad pole-like embryo with a small pointed tail and a large blunt anterior end is formed. This embryo has been designated by Todd (81) as the "active embryonated stage." At this stage, the eggs are non-infective. Further development makes the embryo non-motile; it becomes contracted, the tail being reduced to a mere stub, the anterior oesophagus and oesophageal bulb being visible, the latter in the posterior half of the body This non-motile form has been called the "resting embryonated stage." This is the real infective stage which is reached at a temperature of 37°C. in from 3 to 7 days. The first moult takes place before reaching this stage (Todd, 81). Infection takes place by ingestion of eggs which hatch in the posterior part of the gut. According to Todd, the second

moult takes place after ingestion of eggs and before hatchir The youngest larva measures 150 to 170μ in length and has ar intestine in the form of a simple tube and the entire cuticl annulated like the adult. In slightly older larvae the typical adult form of oesophagus begins to be differentiated A larva twelve days old measures about 430μ in length. in th the oesophagus is divided into corpus, isthmus and bulb and intestinal walls are irregular in outline. The anterior portion of the intestine begins to enlarge. In a larva about 1 m.m. or slightly above, the intestinal diverticulum appears to develop as a pouch of the enlarged anterior intestine. During further growth the intestine begins to form coils or loop, the oesophagus assumes the typical adult form, and the genital primordium is represented by a small mass of cells in the middle of the body. Further growth results in the oesophagus worm appearing just like the adult, with the characteristic oesophagus, an intestinal diverticulum and a greatly coiled intestine; the intestine becomes more distended and less convoluted in the posterior part during further growth. The reproductive anlage extends from the vulva dorsa anf forks into two short branches, one anterior and the othe posterior.

2. Leidynema cranifera Chitwood, 1932 (Fig. 8, J-M).

Specific diagnosis: Leidynema: Male: 790μ long by 40μ wide. Oesophagus 114μ long, consisting of an anterior corpus 55μ long which is subdivided into a longer anterior section 36μ long by 4 to 5μ wide and a posterior shorter section 19μ long by 7 to 8μ wide; an isthmus 33μ long by 5 to 6μ wide, not distinctly set off and a posterior valvular bulb. Intestine simple, anus very near posterior end of truncated part of body. Tail spine-like, arising dorsally, 35μ long. Caudal papillae consisting of one pair of preanal papillae, one pair of adanal or postanal papillae, and a median papilla near the base of the spine-like tail. One spicule, 25 to 30μ long.

Female: 3.17 to 3.8 mm. long by 200 to 250μ wide. Cuticular striae about 10 to 12μ wide in oesophageal region, and 2 to 3μ wide in the body region. Lateral alae not present, or, if present, not observed. Head usually set off as two annules, the anterior of which may be retracted into the adjoining annule. Mouth opening surrounded by a slight circumoral elevation; eight submedian labiopapillae and two [illegible] is present. Mouth cavity somewhat cylindrical. Oesophagus [illegible] to 540μ long; anterior part 360 to 381μ long, subdivided [illegible] a narrow anterior part, 200 to 230μ long by 30 to 40μ [illegible]e, and a wider posterior part, or pseudobulb, 40 to 60μ [illegible]de, isthmus 20 to 48μ long by 25 to 40μ wide; valvular [illegible]lb 90 to 100μ long by 100 to 140μ wide. Nerve ring situated

at posterior end of first subdivision of oesophagus, approximately 130µ from the anterior extremity. Excretory pore posterior to base of oesophagus, 733 to 900µ from anterior end of body. Anterior part of intestine very wide but without indication of caecum, posterior part of intestine not looped; anus 350µ (1) from posterior end of body. Tail filiform; vulva 1.3 to 1.72 mm. from anterior end of body; two ovaries, doubly reflexed, both situated in anterior part of body. Eggs 66 to 80µ long by 32 to 40µ wide, ellipsoidal, segmented at deposition.

Host: Blaberus cranifer Burm., and Blaberus atropos St

Location: Large intestine.

Distribution: Florida, United States of America.

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(1) Chitwood (20) gives this distance as 5 to 77µ, but this is apparently due to some error. A tail with these measurements will be conical and not filiform. From his diagram this distance comes out to be 350µ.

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3. Leidynema delatorrei Chitwood, 1932 (Fig. 8, N-Q)

Specific diagnosis: Leidynema:

Male: 900µ long by 60µ wide. Cuticular striae broken into longitudinal bosses on first 69µ of body length; lateral alae extending from region of bosses posteriorly to within a short distance of anus. Oesophagus 189µ long,

consisting of a simple anterior part, the corpus, 145µ long by 10µ wide; a distinct isthmus 14µ long by 10µ wide and a valvular bulb 30µ long by 28µ wide. Nerve ring not observed. Excretory pore posterior to base of oesophagus, 280µ from anterior end of body. Intestine simple; anus 11µ from posterior end of body. Tail bluntly rounded, bearing a minute caudal spine. Caudal papillae consisting of a pair of large subventral preanal papillae, a pair of small subventral postanal papillae. A pair of ~~lateral~~ subdorsal, nearly terminal, postanal papillae, A pair of later adanal papillae may be present. One spicule, 37µ long.

Female: 3.4 to 3.78 mm. long by 335 to 450µ wide. Lateral alae extending full length of body, not terminating in caudal spine-like processes. Mouth surrounded by eight submedian labiopapillae; amphids present. Oesophagus 506 to 570µ long; corpus subdivided into an anterior slender part 190 to 210µ long by 28 to 30µ wide, and a posterior, cylindrical pseudobulb 180 to 200µ long by 60 to 80µ wide, isthmus 18 to 20µ long by 32 to 40µ wide; bulb 118 to 140µ long by 130 to 140µ wide. Nerve ring not observed. Excretory pore situated posterior to base of oesophagus, 840 to 920µ from anterior end of body. Intestine enlarged anteriorly to form a cardia; caecum and posterior loop of intestine apparently absent; anus 700 to 718µ from posterior end of body. Tail attenuated, not filiform, Vulva 1.4 to 1.63 mm. from anterior end of body; amphidelphic. Eggs oval, slightly flattened on one side, 100 to 108µ long by

40 to 46μ wide, one end more bluntly rounded than the other.

Host: Leucophaea maderae Linn.

Location: Large intestine.

Distribution: Havana, Cuba.

4. Leidynema nocalum Chitwood and Chitwood, 1933. (Fig.8, B-S).

Specific diagnosis: Leidynema:

Male: 1.1 to 2.33 mm. long by 80 to 100μ wide. Cuticular bosses and alae apparently absent. Oral opening hexangular, surrounded by an internal circle of six small papillae and an external circle of eight large papillae. Amphids lateral, pore-like, Buccal cavity short, subtriangular in cross-section. Oesophagus 290 to 294μ long; the anterior part of corpus 100 to 104μ long by 18 to 24μ wide, posterior part 60μ long by 30 to 36μ wide; isthmus 38 to 50μ long by 8 to 10μ wide; bulb 80μ long by 54 to 70μ wide. Nerve ring and excretory pore not observed. Anus 590 to 600μ from posterior end of body; tail attenuated, becoming filiform. Caudal papillae consisting of one pair of large preanal papillae, one pair of small adanal papillae, a medio-ventral postanal organ, and a pair of postanal papillae, near the anus. short, narrow, preanal, subventral alae. Spicule absent.

Female: (non-gravid) 1.84 to 2.2 mm. long by 80 to 100μ wide. Lateral alae absent. Oral opening subtriangular; internal circle of papillae not observed, external circle

consisting of eight labiopapillae; amphids oval. Buccal cavity and oesophagus shaped as in male. Oesophagus 240 to 260μ long; anterior part of corpus 100μ long by 22μ wide, posterior part 60μ long by 40μ wide; isthmus 30μ long by 22μ wide, and bulb 50μ long by 70μ wide. Intestine without caecum or posterior twist. Anus 520 to 560μ from posterior end of body. Tail finely attenuated, not set off from the body. Vulva 600 to 650μ from anterior end of body; uteri apparently at first parallel, directed anteriorly, then divergent.

Host: Panesthia Javanica.

Location: Presumably intestine.

Distribution: Philippine Islands.

Key to the species of the genus Leidynema

1. Female, anterior part of intestine with a caecum, posterior part forming a loop..... L. appendiculatum
   Female intestine without a caecum or a loop.....2

2. Tail of female short and conical with only slight attenuation.....L.delatorrei.
   Tail of female long and finely attenuated.....3

3. Buccal cavity twice as long as wide; male with a short spine-like tail L. cranifera
   Buccal cavity not longer than wide; male with a very long filiform tail....L.nocalum

DISCUSSION

The genus Leidynema was proposed by Schwenk (in Travassos, 86) to accommodate Oxyuris blattae-orientalis Han., 1847. From Hammerschmidt's original description (48) and figures of this worm it becomes apparent that he had only redescribed and redrawn his previously described (47) O. diesingi, and the latter has been placed in the genus Aorurus by Travassos (86). Apparently, Schwenk agrees with Leidy (53) who cites O. blattae orientalis as being the same species as his Thelastomum appendiculatum Bütschli (17), Galeb (44), and Magalhães (61) have followed Leidy in this matter. O. blattae-orientalis now being regarded as a synonym of Hammerschmidtiella diesingi (= O. diesingi), the type species of the genus Leidynema will have the name of L. appendiculatum, this being the original name of the species and meant for the type species of this genus by Schwenk. Chitwood (20) added two species, L. cranifera and L. delatorrei to this genus, and Chitwood and Chitwood (21) added a fourth, L. nocalum. Serrano Sánchez (72) divided the type species, L. appendiculatum, into three varieties, L. appendiculata var. americana, L. appendiculata var. indiana, and L. appendiculata var. hispana. The writer sees no necessity for retaining these varieties as the differences on which they are created these normally come within range of variation of a species.

LEGENDS

Figure 8

(A-I) Leidynema appendiculata.

A. Female, entire.
B. Male, entire.
C. Active embryonated egg.
D. Resting embryonated egg.
E. Twelve-day old female.
F. Young female, showing enlargement of cardia.
G. Female, tail.
H. Male, tail, lateral view.
I. Female, en face view.

(J-M) L.cranifera

J. Female, en face view
K. Female, oesophageal region.
L. Female, tail.
M. Male tail, lateral view.

(N-Q) L. dolatorrei

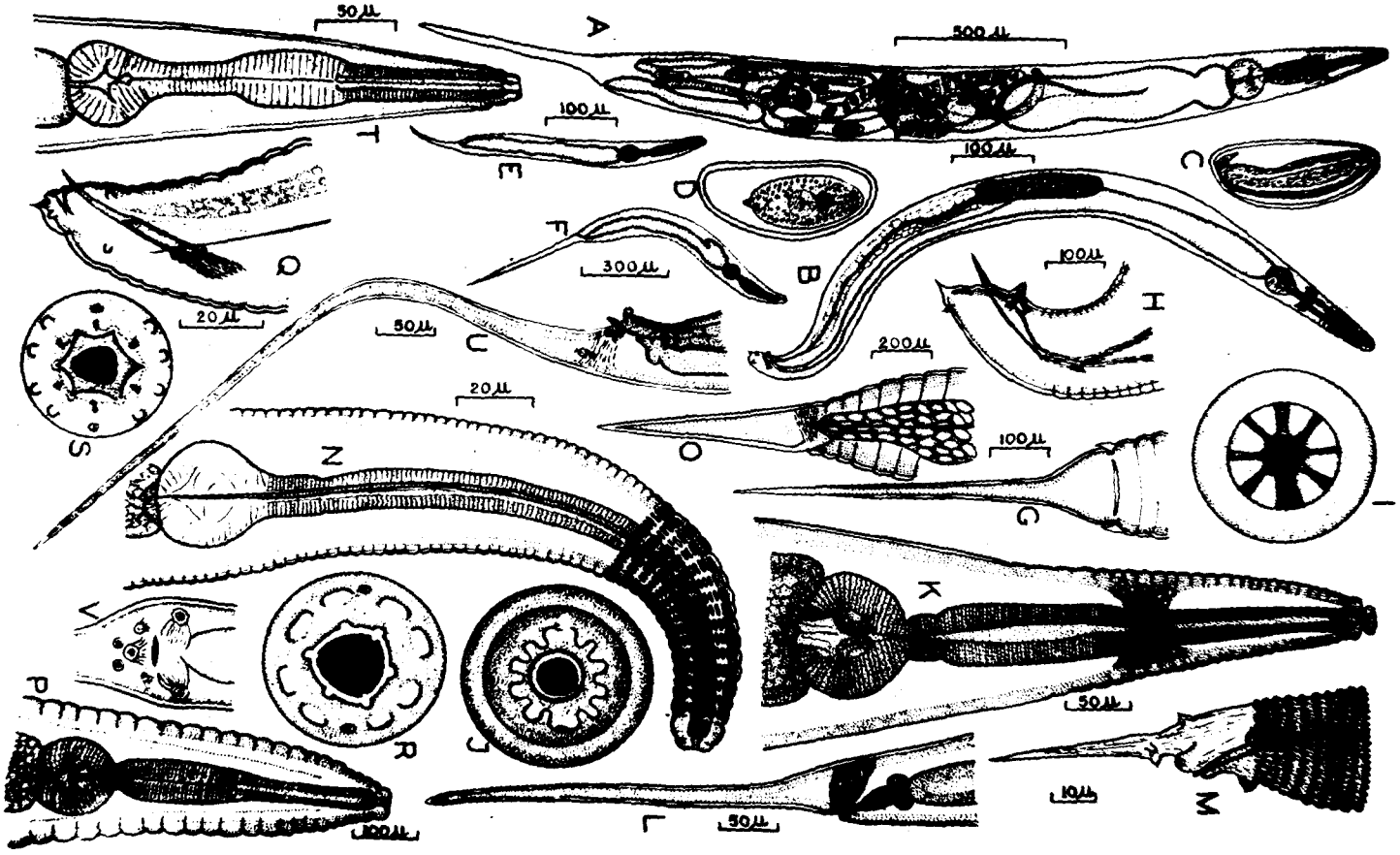
N. Female, oesophageal region.
O. Female, tail.
P. Male, oesophageal region.
Q. Male, tail, lateral view.

(R-V) L. nocalum

R. Female, en face view.
S. Male, en face view.
T. Male, oesophageal region.
U. Male, tail, lateral view.
V. Male, region of cloaca, ventral view.

(A-F) after Dobrovolny and Ackert (39), G.Q after Chitwo

(20), R-V after Chitwood and Chitwood (21).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500µ
100µ
300µ
20µ
200µ
10µ

latter is the true caudal appendage.

Female: 3 to 4 mm. long. The neck bears a series of annular cuticular swellings of different sizes, ten in number in the adult, and arranged in a particular pattern a shown in the figure. Oesophagus consists of an anterior club-shaped corpus, a short but distinct isthmus, and a pos erior valvular bulb. Tail distinctly filiform like Hammerschmidtiella diesingi. Vulva in the mid le of body, uteri divergent; ovaries, two. Eggs ellipsoidal, covered by two spirally wound filaments which unfold in contact wit water, and containing a fully developed embryo when laid.

Host: Hydrophilus piceus.

Location: Presumably intestine.

Distribution: Europe.

2. Pseudonymous islamabadi (Basir, 1941) n. comb. (Fig.9 D-F).

Synonym: Galebiella islamabadi Basir, 1941

Specific diagnosis: Pseudonymous.

Male: Unknown.

Female: 4.3 mm. long by 375μ wide. Head end distinctl set off from the body in the form of 9 inflated cuticular a ules. Behind these the cuticle presents only a few faint st tions, each about 8μ wide. The rest of the body is not stri

Oral opening surrouned by eight labiopapillae; amphids present. Buccal cavity cylindrical, 25μ deep by 12μ wide. Oesophagus 450μ long, consisting of an anterior club-shaped corpus 350μ long by 45μ wide in its anterior part and 55μ wide near its base; a short isthmus, 15μ long by 30μ wide, and a posterior valvular bulb 85μ long by 90μ wide. Nerve ring 270μ and excretory pore 600μ from anterior end of body. Intestine dilated anteriorly to form a slight cardia. Anus 260μ from posterior end of body. Tail conically attenuated. Vulva at about two-thirds of the body, 2.6 mm. from the anterior end. Ovaries, two, the anterior ovary arising at the level of the excretory pore, and the posterior one, a little anterior to the anus. Vagina directed anteriorly; uteri divergent. Eggs oval, 32μ long by 50μ wide, covered over by two spirally coiled filaments, and containing a full developed embryo while within the uterus; the filaments arise from a knob-like swelling situated on one side of the egg a little anterior to the centre.

Host: Hydrophilus piceus (aquatic beetle?),

Location: Intestine.

Distribution: India.

This species can be distinguished from P.spirotheca by the difference in the number of inflated head annules and the form of the tail.

3. Pseudonymous hydrophili (Galeb, 1878)/and Hassall, Stiles 1905 (Fig. 9, G-J).

Synonyms: Oxyuris (Helicothrix) hydrophili Galeb, 1878

Galepiella galebiella Basir, 1941.

Pseudonymous brachycercus Todd, 1944.

Pseudonymous leptocercus Todd, 1944.

Specific diagnosis: Pseudonymous:

Male: 1.0 to 1.5 mm. long, very similar to that of Pseudonymous spirotheca except that in this the caudal appendage is formed of a single piece.

Female: 1.85 to 4.11 mm. long by 145 to 295 μ in width. Head end set off in the form of two enlarged or inflated cuticular annules of which the first is smaller than the second. First annule measures up to 15μ and the second up to 25μ in breadth. Oral opening prismoidal, surrounded by eight labiopapillae; amphids present. Buccal cavity cylindrical, 20μ deep by 3μ wide. Oesophagus 265 to 385μ long by 35 to 47μ wide in its anterior part and about 55μ wide near its base, an isthmus 10 to 20μ long by about 25μ wide, and a posterior valvular bulb 65 to 103μ long by 75 to 113μ wide. Nerve ring 200 to 295μ from anterior end of body. Excretory pore posterior to base of oesophagus, 390 to 650μ fr anterior end of body. Intestine dilated anteriorly to form a slight cardia; anus 255 to 483μ from posterior end of body. Tail conically attenuated. Ovaries two, one anterior and the other posterior; vulva between middle and posterior third of

body, 1.170 to 2.616 mm. from the anterior end. Vagina directed anteriorly, uteri divergent. Eggs oval, 68 to 82μ long by 42 to 52μ wide, with two spiral filaments wound round the shell and containing a fully developed embryo while in the uterus; the filaments arise from a knob-like swelling on one side of the egg, placed slightly away from the equator

Host: Hydrous triangularis (Say), Tropisternus nimbatus Say.
Hydrophilus piceus, (aquatic beetle (?)).

Location: Intestine.

Distribution: Europe, India, United States of America (Nebraska, Louisiana).

This species can be distinguished from both P. spirotheca and P. islamabadi by the number of inflated head annules

4. Pseudonymous hydroi (Galeb, 1873) Stiles and Hassall, 1905.

Synonyms: Oxyuris (Helicothrix) hydroi Galeb, 1873.
Zonothrix tropisterna Todd, 1942.

Specific diagnosis: Pseudonymous:

Male: 0.93 to 1.50 mm. long by 45 to 63μ wide. Oesophagus 181 to 195μ long, consisting of an anterior corpus 150 to 163μ long by 12 to 15μ wide (at nerve ring), a short isthmus and a posterior valvular bulb 31 to 34μ long by 30 to 34μ wide. Anus about 40u from the posterior end of body. Tail conical. Excretory pore much posterior to base of

oesophagus, 245 to 280μ from anterior end of body. Nerve ring 120 to 135μ from anterior end of body. Testis slightly reflexed near its anterior end. Single spicule, 22μ long. Four pairs of caudal papillae, one pair precloacal and three pairs postcloacal, with one single median papilla anterior to the precloacal pair.

Female: 2.5 to 5 mm. long by 140 to 231μ wide. Head end without enlarged annules. Mouth opening prismoidal, surrounded by a circumoral elevation bearing eight submedian papillae; amphids present. Buccal cavity short and cylindrical, 8μ deep by 6μ wide. Oesophagus 315 to 406μ long, consisting of an anterior corpus 238 to 329μ long by 33 to 45μ wide (at nerve ring), and a posterior valvular bulb 70 to 91μ long by 61 to 81μ wide. Excretory pore, a large opening posterior to base of oesophagus, 497 to 686μ from anterior extremity. Nerve ring 210 to 275μ from anterior end of body. Tail conically attenuated. Vulva salient, 1.714 to 2.443 mm. from anterior extremity, its anterior lip prolonged and projected outwards. Vagina directed anteriorly; uteri divergent. Eggs oval, 61 to 70μ long by 39 to 45μ wide, with two filaments wound round the shell and containing a fully formed embryo when deposited; these filaments arise from a knob-like swelling on the shell.

Host: Hydrous scaraboides, Tropisternus nimbatus Say.

Location: Intestine.

Distribution: Europe, United States of America (Nebraska); Canada (Quebec) new record.

This species can be distinguished from all those described previously by the absence of the inflated head annules.

Key to the species of the genus Pseudonymous

1. Head end provided with inflated annular swellings in female 2
   Head end without inflated annular swellings in female.....P. Hydroi.

2. Inflated head annules two in number.....
   P. hydrophili.
   Inflated head annules more than two in number.....3

3. Female with a filiform tail, and vulva at middle of body.....P. spirotheca.
   Female with a short, conical tail and vulva at two-thirds of body.....P. islamabadi.

DISCUSSION

Györy (46) described Oxyuris spirotheca from the aquatic beetle, Hydrophilus piceus. Diesing (37) erected the genus Pseudonymous to receive this worm, which then became P. spirotheca (Gyory, 1856) Diesing, 1857. Diesing (38) again described it under a new and differnnt genus, namely, Ptyocephalus. Galeb (44) removed this worm from the genera Pseudonymous and Ptycocephalus and again placed it in the genus Oxyuris; to accommodate it in this genus, he erected a new subgenus, Helicothrix, and called the worm Oxyuris (Helicothrix) spirotheca (Gyory, 1856) Galeb, 1878. In addition to this worm, Galeb also named three additional new species, placing them in the same subgenus. These are: O. (H.) hydrophili, O.(H) hydroi, and O.(H.) hydrobii. For the third species he states.

> "Nous ne connaissons cette espece que par quelques jeunes individus; mais nous croyons la caracteriser suffisamment, en distant qu'elle vit dans l'intestin de l'Hydrobius fuscipes, Hydrophilidae qu'on trouve tres communement en Europe."

It is clear that this statement cannot suffice for the diagnosis of a species. He gave no figures for this worm and, moreover, it is unnecessary to postulate that a different host species of the same order of insects must be infected with a different parasite. The writer, therefore, feels justified in regarding O(H.) hydrobii as a nom. nudum.

The genus Ptycocephalus Diesing, 1861, and the sub-genus Helicothrix Galeb, 1878 fall naturally as synonyms of Pseudonymous Diesing, 1857, on the ground of priority as indicated by Stiles and Hassall (76).

In 1941 the present writer (7) erected a new genus, Galebiella, to accommodate two different worms from an unidentified aquatic beetle from India, and named them G. galebiella and G. islamabadi. The worms had some similarity to representatives of Pseudonymous, but as the egg filaments could not be observed at the time of describing them, it was thought proper to place them in a separate genus. While reviewing this genus, the same material was again cleared and re-examined carefully, and a further collection from other aquatic beetles was made. These worms show the presence of the characteristic spirally-wound filaments of the egg. Accordingly, the genus Galebiella Basir, 1941, becomes a synonym of the genus Pseudonymous. Of the two species described in the genus Galebiella, the type species, G. galebiella has almost the same characters as those given by Galeb (44) for Pseudonymous hydrophili (= O. (H.)hydroph Thus, the former becomes a synonym of the latter. The other species, G. islamabadi, resembles P.spirotheca to a certain extent, but differs from it in the number and pattern of the inflated head annules, in the position of the vulva which in t

middle of the body in the latter and at two-thirds of the body in the former, and in the form of the tail which is described for the latter as filiform (like that of Hammerschmidtiella diesingi) and short and conical for the former. These differences are in the opinion of the writer more than enough to keep this worm as a separate species. Thus, G. islamabadi now becomes P. islamabadi.

Todd (79) erected a new genus, Zonothrix, to accommodate a worm which he described from the Hydrophilid beetle Tropisternus numbatus, from Nebraska, U.S.A., which he named Z. tropisterna. To distinguish his genus from Pseudonymous he writes:

> "The genus Zonothrix can be distinguished from its most closely related genus, Pseudonymous Diesing, 1857, by the location of the vulva at the posterior third of the body, the prolonged condition of the anterior lip of the vulva, and by the absence of the inflated cuticular rings, or head folds."

Galeb (44), in his description and figures, includes in the genus, Pseudonymous hydroi (= G. (H.) hydroi), a species which possesses all the characters mentioned by Todd (79), as differentiating his genus from Pseudonymous. Regarding this he writes:

> "the two worms agree, as nearly as can be determined from Galeb's description and figures, in the possession of an oesophagus with a valvular bulb, a large excretory pore posterior to base of oesophagus, an egg bearing a coiled filament, and the characteristic prolonged condition of the anterior lip of the vulva."

The position of the vulva as shown in Galeb's figure is the same as that described by Todd for his worm. The writer,

after careful consideration, concludes that Z. tropisterna Todd, 1942, is a synonym of Pseudonymous hydroi (Galeb,187 and, therefore the genus Zonothrix, becomes a synonym of t genus Pseudonymous. The only character on which the two were separated was the presence in the latter of the infla head annules and their absence in the former. Other charac ers being the same, it is not thought justifiable to base a separate genus on this.

The same author (32) described two new species of the genus Pseudonymous, (P. brachycercus) and P. leptocercu i; from the aquatic beetle, Hydrous triangularis (Say) from Nebraska, U.S.A. To distinguish these two new species from each other, he wrote:

> "P. leptocercus can be distinguished from P. brachycer by its smaller size (2.47-2.94 mm. compared to 3.15-4.11 mm.) and because it has a filiform tail."

From his diagrams it is clear that the smaller species is a comparatively young worm with few eggs in the uteri. In any event, this small size variation is not enough for specific differentiation. The present writer has seen representati of Thelastomatidae where mature worms of the same species a from the same host, vary in length from 1.5 to 5 mm. or eve more. The other distinguishing character mentioned is the difference in the tail which is described as filiform for the smaller species. As a matter of fact, a filiform tail should be, comparatively, much longer than the attenuated tail. Calculating from Todd's figures, the average length of tail for P. brachycercus, his larger species, comes to

16.5% of the average body length of the worm and for P. leptocercus, his smaller species, it comes to 15.6% of t average body length. Thus, the tail of the latter instead of being longer is slightly shorter than that of the forme The present writer has in his collection, worms of this species which could fit easily into the extremes given for both the species described by Todd, and there is a full ser of intergrades. Accordingly, he concludes that these two species are identical.

Both Todd's species closely resemble P. hydrophili (Galeb, 1873) (= O.(H.) hydrophili). To distinguish P. brachycercus from the latter Todd wrote:

> "Of the two new worms, P. brachycercus appears to resemble P. hydrophili (Galeb, 1873). The length of the female P. hydrophili is given by Galeb as 4 mm., which is within the limits of the length of P. brachycercus, that is, 3.15-4.11 mm. The two worms cannot be further distinguished because a full description of P. hydrophili was not given."

As these two worms in Todd's own words, cannot be distinguished, P. brachycercus becones a synonym P. hydrophili, and as P. leptocercus is a synonym of the former, it also becomes a synonym. However, Todd's descriptions of these worms are new records from the United States and from a new host.

LEGENDS

Figure 9.

(A) Pseudonynous spirotheca.

A. Female, oesophageal region.

(B-F) P. islamabadi

B. Female, entire.
C. Female, en face view
D. Female, head end, magnified.
E. Female, oesophageal region.
F. Egg with broken filaments.

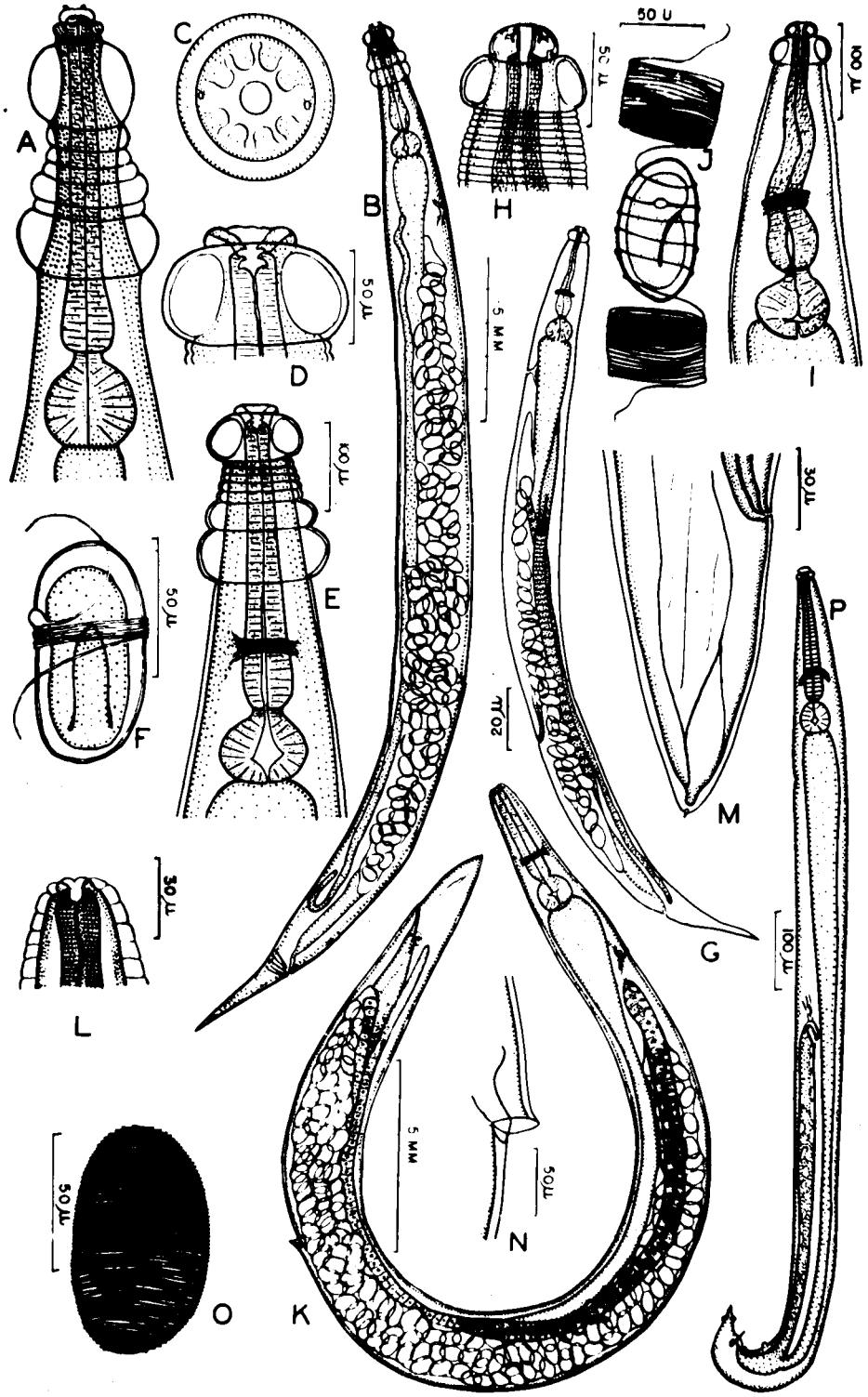
(G-J) P. hydrophili

G. Female, entire.
H. Female, head end, magnified.
I. Female, oesophageal region.
J. Egg with filaments unfolding in water.

(K-P) P. hydroi.

K. Female, entire.
L. Female, head end, magnified.
M. Female, tail.
N. Female, region of vulva showing anterior lip, magnified.
O. Egg, with coiled filaments as laid.
P. Male, entire.

(A.- after Golob (43); P, after Todd (81); remainder original.)


A
B
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5 MM
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50 µ
20 µ
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5 MM
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GENUS BINEMA TRAVASSOS, 1925

Synonyms: Oxyuris Rud., 1803 (in part);
Periplaneticola Basir, 1940;
Gryllocola Basir, 1942.
Talpicola Basir, 1942.

Generic diagnosis: Thelastomatidae: Mouth opening prismodal, surrounded by eight submedian labiopapillae and two amphids. Buccal cavity simple, short and cylindrical. Oesophagus comparatively short, consisting of an anterior almost cylindrical corpus, a short isthmus and a posterior valvular bulb. Intestine may have or may not have a prominent anterior dilatation. Excretory pore posterior to base of oesophagus. Nerve ring almost in the middle of corpus. Vulva posterior to middle of body. Ovaries two; one anterior and the other posterior. Uteri divergent; each set of reproductive organs forming about four loops. Tail of female short, conical or greatly reduced. Tail of male truncated, bearing distinct lateral alae and four pairs of caudal papillae; two pairs of preanal, one pair of adanal, and one pair of postanal. Eggs oval, encapsulated in two's or three's; rarely capsules with eggs varying in numbers from one to seven are seen.

Type species: Binema korsakowi (Bergiev, 1923) n. comb.

1. Binema korsakowi (Sergiev, 1923) n. comb. (Fig. 10, A-F)

Synonyms: Oxyuris korsakowi Sergiev, 1923;
Binema binema Travassos, 1925
Gryllocola gryllocola Basir, 1942;
Binema (Binema) hispana Serrano Sánchez,194
Binema (Binema) medinae Serrano Sánchez,194

Specific diagnosis: Binema:

Male:- (Specific identity doubtful). 90 to 1.45 mm. long by about 150μ wide. The following measurements are from a worm measuring 1.03 mm. in length. Cuticle bearing striations only in the anterior part of body, anterior to nerve ring. Cervical and caudal alae present. First two annules comparatively large, about 18μ wide. remaining annules about 6μ apart. Buccal cavity long and cylindrical, 30μ deep by 15μ wide. Oesophagus 310μ long, consisting of a corpus 245μ long by 25μ wide, an isthmus 16μ long by 10μ wide, and a posterior valvular bulb, 65μ long by 55μ wide, Nerve ring 150μ from the anterior end of body. Excretory pore posterior to base of oesophagus. Anus close to posterior extremity, ventrally situated. Tail completely truncated. Caudal papillae four pairs, rather large; one pair large subventral preanal, one pair medioventral preanal, one pair adanal, and one pair of subdorsal postanal; Caudal alae prominent. Spicule

absent; replaced by a median ventral rod-like fine projection very much resembling the spicule.

Female: Body more or less spindle shaped with its maximum width at the centre, narrowing towards the extremities, 1.35 to 1.1 m. long by 230μ in maximum width The following measurements are taken from a worm 2.61 m. long by 280μ wide. Cuticle bearing only a few striations near the anterior extremity. Oral opening prismoidal surrounded by a circumoral projection and eight labio-papillae. Amphids present in the form of fairly large circular openings. Buccal cavity not conspicuous, almost absent. Oesophagus 420μ long, consisting of a corpus 310μ long by 30μ wide, a short isthmus 10μ long by 20μ wide, and a posterior valvular, almost spherical bulb, 100μ long by 105μ wide. Nerve ring lying at about the middle of corpus, 150μ from the anterior end of body. Excretory pore post-bulbar, 560μ from the anterior end. Intestine slightly enlarged anteriorly but the dilatation constantly remains less in diameter than the oesophageal bulb. Anus 265μ from posterior end of body. Tail narrows gradually into a conic form. Vulva at about two-thirds of the body, 1.61 m. from the anterior end; vagina directed anteriorly, difficult to see in a gravid worm where it gets covered over by the bulk uteri. Ovaries two, one lying anteriorly and the other

posteriorly; both ovaries reflexed. Each set of reproductive organs forming four loops; uteri divergent. Eggs bearing a bunch of filaments at each pole, laid in capsules, each capsule usually containing two or three eggs. Rarely capsules with varying number of eggs are passed out, the number of eggs in each capsule ranging from one to seven. The size of the capsule depends on the number of eggs contained in it. Individual eggs measure 59 to 64μ long by 34 to 40μ wide and are usually laid before segmentation starts. However, in some cases may be laid in two to four celled stage.

Host: Gryllotalpa vulgaris; G. europeus L.; G. africana Beauv.; Neocurtilla hexadactyla Perty.

Location: Posterior intestine.

Distribution: Crimea (U.S.S.R.), Rio de Janeiro (Brazil), N. India, Spain.

2. Dinema ornata Travassos, 1925. (Fig. 10, G-J).

Synonyms: Talpicola talpicola Basir, 1942;

Dinema (Ornata) ornata (Travassos, 19
Serrano Sánchez, 1947;

Dinema (Ornata) techae Serrano Sánchez 1947.

Specific diagnosis: Dinema :

Male: Unknown.

Female: Body comparatively thinner and longer, almost cylindrical in the region of the reproductive organs, 2.5 to 3.5 mm. long, narrowing slightly anteriorl in front of the excretory pore, and posteriorly behind th last flexture of the uterus. The following measurements are taken from a worm 3.27 mm. long by 225μ at its widest Lateral alae conspicuous throughout the whole length of the body. Apart from the head annule almost no striations are present on the body, except for a few faint ones. Oral opening subtriangular, surrounded by eight labiopapillae. Buccal cavity about 20μ deep by 10μ wide, partly surrounded by the oesophagus, its walls presenting the so called ornamentation which appear as striations, or lateral thickenings or projections. It assumes a variable shape depending on the degree of the contraction or extention of the head end. This has probably lead to the creation of several species of this worm. Oesophagus comparatively short, 345μ long, consisting of an almost cylindrical corpus 240μ long by 30μ wide, an isthmus 15μ long by 24μ wide and a posterior valvular bulb 90μ long by 90μ wide. Nerve ring at about the middle of corpus, 130μ from the anterior end of body. Excretory pore posterior to base of oesophagus, 520μ from the anterior end. Intestine enlarged anteriorly to form a cardia which is

usually wider than the oesophageal bulb but not much wider. Anus 115μ from the tip of tail. Tail very short, conical, ending in a minute caudal appendage. Vulva between middle and posterior third of body, 1.8 mm. from the anterior end. Vagina directed anteriorly, difficult to see in specimens full of eggs. Reproductive organs constantly confined to the middle two-fourths of the body. Two ovaries, one anterior, and the other posterior; both reflexed. Each set of reproductive organs forming four loops. Anteriorly these extend to 370μ from the anterior end, posteriorly they remain at a distance of about 630μ from the tip of tail; even in gravid specimens they do not extend much further. Uteri divergent. Eggs bear a bunch of filaments at each pole, laid in capsules, each capsule usually containing two or three eggs. Occasionally capsules have been observed to contain any number of eggs ranging from one to seven. Individual eggs measure 56 to 62μ long by 32 to 36μ wide. Segmentation may start before eggs are laid but never reaches more than four-celled stage.

Host: Neocurtilla hexadactyla Perty; Gryllotalpa africana Beauv.; Gryllotalpa europeus L.

Location: Posterior intestine.

Distribution: Rio (Brazil), India, Spain.

B. ornata differs from B. korsakowi in the form of body, in being comparatively much longer and more slender, in the possession of distinct lateral alae throughout the whole length of its body, in the form of the tail, in the limitation of the extent of its reproductive organs in the middle two-fourths of body, in the form of the buccal cavity, in the more anterior position of the vulva, and in the possession of a comparatively short oesophagus.

3. Binema mirzaia (Basir, 1942) n. comb. (Fig. 10, K-M)

Synonyms: Periplaneticola mirzaia Basir, 1940;
Periplaneticola periplaneticola Basir, 194

Specific diagnosis: Binema:

Male: Unknown.

Female: Body almost cylindrical, tapering only in the region of the oesophagus anteriorly and in the posterior most part, 2.5 to 4.94 mm. long. The following measurements are taken from a worm 3.0 mm. long by 330μ in maximum width. Cuticle striated only in the region of the head, striae about 6μ wide. Oral opening subtriangular, surrounded by eight labiopapillae. Buccal cavity simple, without any ornamentation, cylindrical, 22μ long by 10μ wide, partly surrounded by the oesophagus. Oesophagus

450μ long, consisting of a corpus 345μ long by 40μ wide, a short isthmus 10μ long by 20μ wide, and a posterior valvular bulb 95μ long by 100μ wide. Nerve ring 200μ and excretory pore 700μ from the anterior end of body. Intestine enlarged anteriorly to form a distinct cardia. Anus 90μ from the posterior end of body. Tail very short and blunt with a very small caudal appendage, about 30μ long, distinctly set off from the main body. Vulva at about 70% of the body length, 2.12 mm. from the anterior end. Vagina directed anteriorly. Two ovaries, one anterior and the other posterior; both reflexed. Each set of reproductive organs forming four loops. These extend anteriorly very near to the excretory pore and posteriorly to within 300μ of the anus and are not confined to the middle region of the body as in the previous species. Uteri divergent. Eggs with a bunch of polar filaments arising from each pole, laid in capsules, each capsule usually containing two or three eggs. Occasionally capsules with a varying number of eggs are passed out, the number of eggs ranging from one to five. Individual eggs measure 60 to 66μ long by 36 to 42μ wide.

Host: Gryllotalpa africana Beauv.

Location: Posterior intestine.

Distribution: India.

B. mirzaia differs from B.korsakowi in the form of its body, in the structure of its buccal cavity, in the shape and size of the tail, and in having a more posterior vulva. It differs from B. ornata in being comparatively much fatter, in the form of its buccal cavity, in having a longer oesophagus, a much more posterior vulva and more extensive reproductive organs.

Key to the Species of the Genus Dinena

1. Buccal cavity imperceptible; tail narrowing gradually into a conical form, comparatively long, between 250 and 300μ in length. ..... D. korsakowi

   Buccal cavity distinct; tail very short, less than 150μ in length and ending in a short caudal appendage quite distinct from the main body.....2

2. Worms comparatively long and slender with distinct lateral alae throughout the whole length of body, a short oesophagus; vulva in the middle third of the body; reproductive organs confined to the middle two-fourths of body; buccal cavity with ornamentation.....D. ornata

   Worms comparatively shorter and fatter, with a longer oesophagus; lateral alae not distinct; vulva posterior to middle third of body, at about 70% of body length, reproductive organs extending to the region of anus posteriorly and upto the region of the excretory pore anteriorly.....B. mirzaia

DISCUSSION

The genus Dinema was proposed by Travassos (34) to accommodate two worms which he got from Gryllotalpa. He named them D. dinema and D. ornata. Because of the form of egg capsules he was not sure of the systematic position of these nematodes but provisionally placed them in the Oxyuroidea along with the parasites of Myriapods. The same author (36) later placed this genus in a new family Thelastomatidae (= Thelastomidae) proposed by him. Chitwood (20,21) also placed this genus in this family.

Sergiev (71) had described two worms from the Crimea (U.S.S.R.) from Gryllotalpa europeus and had named them Thelastoma skrjabini and Oxyuris korsakovi. Of these the latter is identical with Dinema dinema. Therefore, D. Dinema according to rules of priority should now be called D. korsakovi (Sergiev, 1923) n. comb.

Basir (5) proposed a new genus for a worm from Periplaneta americana and called it Periplaneticola mirzai. The worm was immature and contained no eggs. Later (8) he described another species of this genus from Gryllotalpa and named it P. periplaneticola. After a restudy of fresh material the writer now feels that both these species shoul be regarded as identical and be placed in the genus Dinema as they have characters very similar to those of the latter

genus. Thus P. periplaneticola ... become P. mirzaia and the latter now becomes B. mirzaia comb.

Basir (3) also described two new ge... from Gryllotalpa to accommodate two worms which he called G... and Talpicola talpicola, ~~in the~~ As the stu...ola gryllocola served specimens only, the eggs could not be s...based on pre- at the time of describing these genera. After stu...operly material it is proposed that both these genera be ma... to the genus Binema, and the species G. gryllocola be garde... as a synonym of B. korsakowi and T. talpicola a synonym o... B. ornata.

Serrano Sánchez (72) subdivided the genus Binema into two subgenera, Binema (Binema) and Binema (Ornata), making B. binema Travassos, the type species of the former and B. ornata the type species of the latter. He also described four new species and placed two in the subgenus B. (Binema), naming them B. (B.) hispana and B. (B.) medinae and the other two in the subgenus B. (Ornata) naming them B.(O.) techae and B. (O.) ormeloi.

She distinguished her species, B. (B.) medinae, from the other two species of the subgenus by saying that the excretory pore in the former lies level with the base of the oesophagus while in others it is much posterior to

it. From her figures it appears that her worms had undergone substantial shrinkage. Moreover, in her diagnosis of this species she gives the distance of the excretory pore as 600µ from the anterior end of the body, whereas the oesophagus with the bulb is 530µ only in a worm measuring less than 3 mm. in length. In B. (B.) hispana, where the total length of the worm is given as 3.05 to 4.10 mm., the oesophagus including the bulb measures only 412 to430µ, whereas the excretory pore lies at a distance of 650µ from the anterior end of the body. The present author feels that this slight difference is not sufficient for the creation of a new species and that the two species described by Serrano Sánchez are identical. B. (B.) hispana has been distinguished from B. (B.) binema Travassos mainly on the difference in size. Travassos (84) gave the length for his species as 2.2 to 2.4 mm., whereas Serrano Sánchez (72) found her species to measure 3.5 to 4.1 mm. In the present author's opinion this small difference in size is not enough to separate two species, if all other characters are the same. The author has in his collection worms belonging to this species which go to even smaller sizes than given by Travassos and larger than given by Serrano Sánchez. Therefore, it is proposed that B. (B.) hispana be regarded as a synonym of B. (B.) binema Travassos.

Serrano Sánchez (72) differentiates her species B. (O.) techae and B. (O.) carmeloi from B. ornata Travassos, on an almost imperceptible difference in the size of the oesophageal bulb and the caudal appendage. In B. ornata Travassos, these are 80μ and 100μ, respectively, while in both of Serrano Sánchez' species these are 100μ and 50μ respectively. Serrano Sánchez distinguishes her species B. (O.) carmeloi from B. (O.) techae on a very slight difference in size, in buccal structure, in the form of the intestine, in the extent of the uterus, the position of the vulva and the size of the egg capsules. From her description these differences appear to be so slight that species could not be spearated on them. Thus both these species should be regarded as identical and synonyms of B. ornata Travassos.

The present author feels further that there is no necessity for the division of the genus Binema into the two subgenera as proposed by Serrano Sánchez.

This leaves the genus Binema with three species only, viz. B. korsakowi (Sergiev, 1933) n. comb.; B. ornata Travassos, 1925; and B. mirzaia Basir, 1940.

LEGENDS

Figure 10

(A-F) Dinema korsakowi

A. Female, entire.

B. Female, en face view.
C. Female, head end, magnified.
D. Egg capsule as laid.
E. Male (?) entire.
F. Male (?) tail, ventral view.

(G-J) D. ornata

G. Female , entire.
H. Female, en face view.
I. Female, head end, magnified.
J. Eggs after the opening of the capsule in glycerine.

(K-M) D. mirzaia

K. Female, entire.
L. Female, en face view.
M. Female head end, magnified.

(All original).

A
5 MM
B
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C
50 μ
D
20 μ
E
5 MM
F
50 μ
K
5 MM
L
20 μ
M
50 μ
H
20 μ
I
50 μ
J
50 μ
G
500 μ

1. Hystrignathus rigidus Leidy, 1850 (Fig. 11, A-F).

Synonym: Anguillula (Hystrignathus) rigidus (Leidy, 1850) Diesing, 1861.

Specific diagnosis: Hystrignathus:

Male: Identity questionable. (Christie, (1934) after examining a large number of beetles from various parts of the United States wrote that they were invariably found to harbour females of both species of this genus. Males were also present but these could not be separated into two species on the basis of morphological characters. They belong either to one of these two species or perhaps to both. He provisionally assigned the males to the type species).

Body 660 to 930μ long by 40 to 50μ wide. Narrow but distinct lateral alae are present, extending from near nerve ring to a point slightly in front of anus. Spines lacking. First 3 or 4 annules behind head region indistinct, succeeding annules about 3μ wide, decreasing gradually in width and becoming less distinct posteriorly. Head not set off; cephalic papillae not seen. Oesophagus 190 to 220μ long, corpus sub-cylindrical, faintly expanded near head; isthmus long, bulb pyriform. Christie (29) gave the following measurements in a specimen 930μ long; corpus 130μ long by 8μ wide at anterior end and

GENUS HYSTRIGNATHUS LEIDY, 1850

Synonyms: Anguillula Diesing, 1861;

Kyo Cobb, 1898.

Generic diagnosis: Thelastomatidae:

Male: With cuticle on dorsal side markedly thickened. Cuticular spines lacking. Narrow but distinct lateral alae present. Head not set off. Buccal cavity short. Oesophagus consisting of a sub-cylindrical corpus, faintly expanded near head, a long isthmus and a pyriform bulb. Excretory pore considerably posterior to base of oesophagus. Tail short and truncated. Testis outstretched. At least two pairs of caudal papillae; one pair of conspicuous preanal papillae and one pair of small postanal papillae. Spicule lacking.

Female: With cervical region bearing backward pointing cuticular spines. Mouth surrounded by 6 cephalic papillae. Buccal cavity short. Oesophagus consisting of a sub-cylindrical corpus, an isthmus and a posterior valvular bulb. Excretory pore posterior to base of oesophagus. Tail attenuated. Vulva at or slightly posterior to middle of body. Ovaries two, uteri divergent. Eggs ellipsoidal, unsegmented at deposition.

Type species: Hystrignathus rigidus Leidy, 1850

11μ wide at base; isthmus 22μ long by 8μ wide; bulb 31μ long by 25μ wide. Nerve ring 110 to 140μ from anterior end of body. Intestine slightly dilated anteriorly. Anus nearly terminal, about 10μ from caudal extremity. Caudal papillae 1 pair preanal and 1 pair postanal. Tail ending in papillae -like projection. Spicule lacking. On dorsal side of tail a thickening of the cuticle about 25μ long and extending nearly to the terminus. Testis outstretched, and usually lying in front of the excretory pore.

Female: With body 2.13 to 4 [illegible]. long by 170 to 200μ wide, reaching its greatest width between base of oesophagus and excretory pore. First annule behind head 12μ wide and without spines, not distinctly wider than succeeding annules which increase gradually in width posteriad and become less distinct. Beginning at the second annule and extending to slightly in front of excretory pore, 16 longitudinal rows of sharp, backward-pointing, cuticular spines; these, 8μ long on the 2nd annule, reach a length of 18μ on about the 5th and 6th annules, then decrease in size posteriad and end on about the 106th annule as minute points. Head 10μ long by 34μ wide, shaped like a truncate cone; external circle of 8 papillae tending to be arranged in pairs. Stoma sub-cylindrical, not sharply differentiated from lumen of oesophagus; unarmed. Oesophagus 650 to 670μ

long, corpus sub-cylindrical. A specimen 4.2 mm. long gave the following measurements: corpus 507μ long by 30μ wide at anterior end and 50μ wide at base; isthmus 63μ long by 24μ wide; bulb 85μ long by 70μ wide. Nerve ring 250 to 340μ from anterior end of body. Excretory pore 1.13 mm. from anterior end of body. Intestine with a somewhat elongate, oval, anterior dilatation. Anus 470 to 520μ from caudal extremity. Tail attenuated, not sharply differentiated from remainder of body. Vulva 1.5 to 2 mm. from anterior end of body, not salient; vagina directed anteriad; two ovaries. Eggs ellipsoidal, 100 to 110μ long by 38 to 44μ wide, unsegmented at deposition

Host: Passalus cornatus.

Location: Intestine.

Distribution: U.S.A.

2. Hystrignathus histrix (Cobb, 1898) Johnston, 1912, (Fig. 11, G-H).

Synonym: Xyo histrix Cobb, 1893.

Specific diagnosis: Hystrignathus:

Male: Identity questionnable.

Female: Characters as in H. rigidus but with the following differences: cuticle without distinct annu bearing 32 longitudinal rows of backward-pointing spines

beginning about 8μ behind head and extending nearly to region of excretory pore; these spines arranged in obscure transverse rows and the members of each transverse row alternating with those of the two adjacent transverse rows; near head, spines 4 to 5μ long, gradually increasing in length posteriad to about 10μ, then gradually decreasing and becoming minute points. Head about 15μ long by 32μ wide. Anus 250 to 390μ from caudal extremity.

Hosts: Passalus sp. and Passalus cornatus.

Location: Intestine.

Distribution: Australia and U.S.A.

3. Hystrignathus tarda (Artigas, 1923) n. comb. (Fig. 11,I)

Synonym: Lepidonema tarda Artigas, 1928

Specific diagnosis: Hystrignathus:

Male: Unknown.

Female: 2.32 mm. long by 270μ in width. Cuticle with transverse striations, bearing spines in the anterior region of body, extending to the level of the oesophageal bulb. Three lips (?), not salient; buccal cavity not well differentiated. Oesophagus 490μ long; corpus cylindrical, 400μ long (Artigas gave the length of corpus 300μ but measurements from his diagram show it to be only

400µ); isthmus plus bulb 90µ long by 90µ wide. Anus 625µ from the posterior end of body; tail filiform. Two ovaries, one anterior and the other posterior in position, both ovaries reflexed; uteri divergent. Vulva slightly anterior to middle of body, 1.22 mm. from the anterior end; vagina directed anteriorly. Eggs 85µ long by 30µ wide.

Host: Passalid beetles.

Location: Intestine.

Distribution: São Paulo (Brazil).

Artigas (2) placed this worm in the genus Lepidonema Cobb, 1898, and not in the genus Hystrignathus because his worm had two ovaries and he thought that members of the latter genus have only one. He wrote, "os dois generos Lepidonema e Hstrignathus sao muito proximos, mas Lepidonema de prompto se isola pela duplicidade do utero". Christie (29) pointed out that H. rigidus the type species of the genus has two ovaries, and he proposed a new genus for all the monodelphic species placed in this genus by Artigas. He further wrote "likewise the female of L. tarda closely resembles females of Hystrignathus..... We are informed that the male of L. tarda was secured but the material accidentally destroyed and no description was

given. Unless the male of this species resembles the male of L. bifurcata, the writer regards it as probable that L. tarda also should be placed in the genus Hystrignathus." The present writer agrees with Christie and feels that the right place for L. tarda is in the genu Hystrignathus and not in the genus Lepidonema.

Key to the species of the Genus Hystrignathus

1. Female tail attenuate, eggs 100 to 110μ long by 38 to 44μ wide---------- 2
   Female tail filiform, eggs 85μ long by 30u wide--- H. tarda

2. Female with 16 longitudinal rows of cuticular spines in cervical region--- H. rigidus
   Female with 32 longitudinal rows of cuticular spines in cervical region -----H. histrix.

DISCUSSION

The genus Hystrignathus was created by Leidy (52) to accommodate a worm from Passalus cornutus. He called it H. rigidus. Cobb (33) proposed another genus for a very similar worm, also from Passalus sp. and named in Kyo histrix. Johnston (49) made the genus Kyo a synonym of Hystrignathus and thus Kyo histrix became H. histrix. Artigas (1,2) added nine more species to this genus but all of these were monodelphic and were transferred to a new genus, Artigasia, by Christie (29). The writer has now transferred Lepidonema tarda to the genus Hystrignathus, which therefore now contains only three species viz. H. rigidus, H. histrix, and H. tarda.

GENUS LEPIDONEMA COBB, 1898.

Generic diagnosis: Chelastomatidae: Female with cervical region bearing longitudinal rows of backward-pointing cuticular "scales". Length of stoma never greatly exceeding that of head region. Oesophageal corpus sub-cylindrical; isthmus distinct. Tail conical, sometimes bifurcated at terminus. Vulva at or slightly posterior to middle of body; two ovaries. Male with a conical tail, ending in a point (or bifurcated mucro); cuticle on dorsal side not markedly thickened; three pairs of caudal papillae; one pair preanal and two pairs postanal, spaced more or less equidistant; one spicule.

Type species: Lepidonema bifurcata Cobb, 1398.

Lepidonema bifurcata Cobb, 1393 (Fig. 11, J-L)

Specific diagnosis: Lepidonema:

Male: Cuticle without any scales and with faint transverse striations. Head region not distinctly set off. Tail irregularly conoid and apparently ending in a bifurcate mucro. Caudal papillae three pairs; one pair preanal, large, mammiform, submedian, removed from anus; the other near beginning of posterior third of tail. Spicule straight, two-third as long as tail.

Female: Cuticle with transverse markings, 2.4 to 2.8μ apart, visible only on anterior part of body.

Cervical region bearing about twelve longitudinal rows of "scales", of which one row is located on either side of each lateral line; "scales" largest near head. Head region set off by constriction forming a button-like structure at anterior end. Stoma simple, prismoidal, one-fourth as wide as head and twice as deep as wide. Oesophageal corpus sub-cylindrical; isthmus distinct, half as wide as base of corpus; bulb subspheroidal, one-thir as wide as corresponding body region. Nerve ring near base of corpus; excretory pore opposite nerve ring. Tail irregularly conoid, ending in a bifurcated terminus. Vulva slightly elevated; vagina directed anteriad. Two ovaries, extending at least half way to anus and oesophageal bulb respectively, the reflexed, extending past vulva and often again reflexed for a short distance. Eggs 106 to 120µ long by 40 to 48µ wide, rounded at one end and bluntly pointed at the other, deposited after the first stages of segmentation.

Host: Larva of an insect (unidentified)

Location: Intestine.

Distribution: Australia (New South Wales).

The genus Lepidonema was proposed by Cobb, (33) for a worm from the larva of an unidentified insect in

Australia. He named it L. bifurcata. Artigas (2) added another species, L. tarda, to this genus. The latter species has been transferred by the present writer to the genus Hystrignathus, thus leaving only the type species in the genus Lepidonema. Christie (29) remarked that "the female of Lepidonema bifurcata very closely resembles the females of Hystrignathus and the validity of the former genus rests entirely with the male. This is an unfortunate situation as the danger of error in matching males with proper females is all too well known by those who have worked with the thelastomatids!" He obviously overlooked major differences between these two genera. In Lepidonema the excretory pore lies anterior to base of oesophagus and the cervical region bears rows of scales while in Hystrignathus the excretory pore is much posterior to the base of oesophagus and the cervical region bears rows of spines and not scales.

Figure 11

(A-F) Hystrignathus rigidus

A. Adult male (?), entire.
B. Larval male (?), entire.
C. Female, anterior end.
D. Female, en face view.
E. Adult female, entire (cervical spines omitt
F. Larval female.

(G-H) H. histrix

G. Female, anterior end.
H. Female, en face view.

(I) H. tarda

I. Adult female.

(J-L) Lepidonema bifurcata

J. Female, entire.
K. Female, anterior region.
L. Male, tail, lateral view.

(M-O) Oxyuris platyrhaci

M. Female, anterior region.
N. Egg.
O. Male, tail, lateral view.

(P-Q) Oxyuris sumatrensis

P. Female, entire.
Q. Egg.

(A-H after Christie (29); I after Artigas, (2); J-L after Cobb, (33); M-Q after Parona, (63).)

A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
Q
50μ
300μ
30μ
80μ

GENUS PROTRELLOIDES CHITWOOD, 1932

Generic diagnosis: Thelastomatidae: Mouth opening sub-triangular, surrounded by a trilobed circumoral elevation; amphids present; eight sub-median papillae. Oesophagus relatively long, slender. Vulva anterior to base of oesophagus; two ovaries; eggs ellipsoidal, bearing a pair of longitudinal cuticular grooves. Tail of female conical, attenuated. Tail of male digitiform; one spicule.

Type species: Protrelloides paradoxa Chitwood, 193

Protrelloides paradoxa Chitwood, 1932

Specific diagnosis: Protrellodes:

Male: 1.7 to 1.73 mm. long by 80 to 120μ wide. Oesophagus 310μ long; bulb 48μ wide; contour of oesophagus as in female. Intestine simple, anus 40 to 60μ from posterior end of body. Caudal region sharply set off from trunk region, 190 to 200μ long, digitiform. No distinct caudal papillae observed. A pair of papillae may be present near the posterior end of the tail. Spicule 110μ long.

Female: 2.7 to 3.3 mm. long by 210 to 300μ wide. Mouth opening tri-radiate, circumoral elevation divided into three lip-like organs; eight indistinct sub-median papillae; amphids present. Oesophagus 630 to 720μ long, the anterior part slender, cylindrical,

525 to 636μ long by 28 to 33μ wide; isthmus set off distinctly from anterior part but not from the pyriform bulb; the maximum diameter of bulb 80 to 100μ. Nerve ring not observed. Excretory pore 200 to 280μ from anterior end of body. Intestine very slightly enlarged anteriorly; anus 130 to 300μ from posterior end of body. Tail conical, tapering rapidly to form a narrow pointed spine. Vulva 220 to 290μ from anterior end of body; ovejector directed posteriorly; uterus bifurcating at posterior third of body; amphidelphic. Eggs oval, 90 to 118μ long by 46 to 62μ wide. Shell bearing minute cross striations and a pair of longitudinal lateral grooves. The mature eggs are arranged in a double row with their long axes parallel to the long axis of the body in the anterior part of the uterus and in a single row perpendicular to the body axis in the posterior part of the uterus.

Host: Eurycotis floridana Walker

Location: Rectum.

Distribution: U.S.A. (Paradise Key, Florida).

GENUS PROTRELLETA CHITWOOD, 1932

Generic diagnosis: Thelastomatidae: Oral region elevated; head distinctly set off in female; eight digitiform sub-median papillae. Amphids present. Oesophagus of female consisting of an anterior cylindrical part which is not particularly narrow, a short isthmus, and a valvular bulb. Vulva near or slightly posterior to middle of oesophagus; two ovaries. Eggs oval, without cuticular crest. Tail of female attenuated . Tail of male short, bluntly rounded. Spicule absent.

Type species: Protrelleta floridana Chitwood, 1932

Protrelleta floridana Chitwood, 1932.

Specific diagnosis: Protrelleta:

Male: 680 to 860μ long by 70 to 80μ wide. Cuticular striae rather fine, 2 to 3μ wide. Oesophagus 122 to 170μ long; anterior part 80 to 114μ long by about 12μ wide; isthmus 18 to 20μ long by 6 to 8μ wide; bulb 30 to 40μ long by 27 to 30μ wide. Intestine simple, not enlarged anteriorly; anus 14 to 20μ from posterior end of body. Tail bluntly rounded, cuticle on dorsal side of tail thickened; tail provided with two pairs of caudal papillae, one large pair precanal and one small pair postanal. Spicule absent.

Female: 2.27 to 4 mm. long by 126 to 152µ wide. Head set off as two annules, the first annule being narr and bearing the papillae, and the second being three to four times as wide as the first. Mouth opening surround by an indistinct circumoral elevation; eight prominent digitiform papillae; amphids inconspicuous. Oesophagus 340 to 400µ long, consisting of an anterior part 240 to 304µ long by 22 to 30µ wide, followed by an isthmus 10 t 22µ long by 18 to 24µ wide, and a valvular bulb 50 to 6(wide. Nerve ring about 180µ from anterior end of body. Excretory pore at the same level as, or very slightly posterior to, nerve ring. Intestine simple; cardia indistinct; anus 134 to 190µ from posterior end of body. Tail attenuated. Vulva 132 to 203µ from anterior end of body; ovejector directed posteriorly. Uterus bifurcating near middle of body; amphidelphic. Eggs elongate, grooved, 80 to 90µ long by 36 to 40µ wide.

Host: Blaberus cranifer Burm.

Location: Large intestine.

Distribution: U.S.A. (Florida).

GENUS PROTRELLUS COBB, 1920

Synonym: Protrellina Chitwood, 1932.

Generic diagnosis: Thelastomatidae: Mouth surrounded by eight labiopapillae; amphids present. Oesophagus consisting of an anterior corpus, an isthmus, and a posterior valvular bulb. Vulva anterior to base of oesophagus. Eggs oval or ellipsoidal, usually bearing a cuticular crest either laterally or towards one of the poles, which is often highly coloured, golden in mature eggs. Tail of female relatively short, conical, never filiform. Male much smaller than female; 2 to 3 pairs of caudal papillae; one spicule.

Type species: Protrellus aureus Cobb, 1920

Protrellus aureus Cobb, 1920

Specific diagnosis: Protrellus:

Male: 610μ long by 47μ wide. Cuticle finely striated; striae 3μ wide in middle part of body and 2μ wide in neck region. Lips conical, small papillae present. Oesophagus 133μ long; anterior three-fifths of oesophagus tubular, posterior part flask-shaped. Nerve ring situated 61μ from anterior end of body. Intestine simple; anus 61.4μ from posterior end of body. Tail tapering rapidly; three pairs of caudal papillae, one large. One spicule, linear and acute.

Female: 6 mm. long by 100μ wide; annules upto 20μ wide. Mouth cavity prismoidal, mouth opening surrour by 6 (?) lips, each bearing a papilla. Oesophagus 438μ l having a valvular bulb. Anterior end of intestine enlarge to form a cardia; length of rectum one and one-half times the diameter of the body at anus; anus situated 183μ from posterior end of body; Tail acutely pointed. Vulva 318μ from anterior end of body; vagina directed posteriorly; two ovaries, both reflexed. The eggs in the proximal par of the ovaries and in the uterus have the less pointed en saddled with a peculiar organ. Eggs 104μ long by 50μ wide

Host: Polyzoetaria melanaria Erichs. (probably P. analis Gauss.)

Location: Rectum.

Distribution: Australia (Moss Vale, N.S. Wales.)

2. Protrellus aurifluus (Chitwood, 1932) n. comb.

Synonym: Protrellina aurifluus Chitwood, 1932.

Specific diagnosis: Protrellus:

Male: 290μ long by 13μ wide. Oesophagus 73μ long, somewhat rhabditoid, probably juvenile in character Intestine simple; anus 32μ from posterior end of body. Tail conical, provided with at least one pair of preanal

and one pair of postanal caudal papillae. One spicule, 17μ long.

Female: 3.4 to 5.2 mm. long by 113 to 160μ wide. Mouth opening somewhat prismoidal. Amphids present, at the same level as the eight sub-median labio-papillae; no nerve endings seen in the latter. Oesophagus 270 to 330μ long; anterior clavate part 209 to 273μ long, followed by a short isthmus not distinctly set off from the bulb. Nerve ring situated 70 to 90μ from anterior end of body. Excretory pore immediately in front of vulva. Intestine simple; slight cardia present; anus 100 to 109μ from posterior end of body. Tail conical; dorsal surface arc-shaped. Vulva 173 to 250μ from anterior end of body; vagina directed posteriorly; uterus bifurcates approximately one-third of body length from posterior end. Eggs 85 to 90μ long by 36 to 41μ wide, crest present; mature eggs golden.

Host: Parcoblatta lata Brunn.

Location: Rectum.

Distribution: U.S.A. (Chadbourn, N.C.; White Lake, N.C.; Smith Island, N.C., and St. Mary's, Md.).

3. Protrellus manni (Chitwood, 1932) n. comb.

Synonym: Protrellina manni Chitwood, 1932.

Specific diagnosis: Protrellus:

Male: Unknown.

Female: 2.62 mm. long by 100µ wide. Mouth surrounded by eight sub-median labiopapillae. Oesophagus 390µ long; anterior part 304µ long by 30µ wide, isthmus indistinctly set off, bulb 80µ wide. Nerve ring not observed: Excretory pore 179µ from anterior end of body. Intestine simple, slightly enlarged at base of the oesophagus; anus 140µ from posterior end of body. Tail conical, tapering, with a distant constriction about 40µ from anus. Vulva 233µ from anterior end of body. Eggs 90 to 95µ long by 40 to 45µ wide; shell brownish-yellow and bearing a crest with cuticular bosses.

Host: Aglaopteryx diaphana Fab.

Location: Large intestine.

Distribution: West Indies (Pinares, Cuba).

4. Protrellus australasiae (Pessoa and Correa, 1926) Travassos, 1929.

Synonyms: Oxyuris australasiae Pessoa and Correa, 1926

Protrellina australasiae (Pessoa and Correa 1926) Chitwood, 1932.

Specific diagnosis: Protrellus:

Male: Unknown.

Female: 2.7 to 2.75 mm. long by 220μ wide. Oesophagus 400μ long, consisting of an anterior club-shaped part 270 to 310μ long, an inconspicuous isthmus, and a valvular bulb. Intestine dilated anteriorly to form a cardia; anus 270μ from posterior end of body. Tail conical. Vulva 200 to 220μ from anterior end of body; ovary single (?). Eggs 75 to 78μ long by 45 to 47μ wide, flattened on one side; perivitelline fluid yellowish-green, eggs resembling the eggs of P. Künckeli.

Host: Periplaneta australasiae.

Location: Presumably rectum.

Distribution: South America (Ubatuba, Brazil).

5. Protrellus künckeli (Galeb, 1878) Travassos, 1929.

Synonyms: Oxyuris künckeli Galeb, 1878.

Protrellina künckeli (Galeb, 1878) Chitwood, 1932.

Specific diagnosis: Protrellus:

Male: 800μ to 1 mm. long by 37μ wide. Oesophagus 207μ long; shape approximately as in female. Tail conically pointed. Caudal papillae neither described nor figured. One spicule, 50u long.

Female: 5 to 6 mm. long by 300μ wide. Oesophagus 633μ long; anterior part club-shaped, separated by an indistinct isthmus from a valvular bulb. Intestine simple; anus 233μ from posterior end of body. Tail conical. Vulva 566μ from anterior end of body; uterus bifurcating one-third of the length of the body from the posterior end. Eggs 130 to 130μ long by 70 to 100μ wide, shell bearing a lateral crest, previtelline fluid greenish-brown.

Host: Periplaneta americana Linn. (Chitwood, 1932; suggests the possibility of the host having been mis-identified, as he was unable to find these nematodes after examining a large number of specimens from U.S.A. and China.).

Location: Rectum.

Distribution: (?) Africa.

6. Protrellus galebi Schwenk, 1926.

Synonymi Protrellina galebi (Schwenk, 1926) Chitwood, 1932.

Male: 270μ long by 24μ wide. Oesophagus consisting of an anterior part, 34μ long by 6 to 7μ wide; isthmus 24μ long by 5μ wide; and bulb 10μ wide. Intest simple; anus 34μ from posterior end of body. Tail coni 3 pairs of caudal papillae, one pair preanal, two pairs ventral and postanal, and one (?) pair sub-lateral and

anal. One spicule, 15 to 20μ long.

Female: 5.5 to 7.8 mm. long by 220 to 250μ wide. Oesophagus 500μ long; anterior part 333 to 338μ long by 38μ wide, isthmus 23 to 30μ long; bulb 69 to 84μ wide. Nerve ring situated 134μ from anterior end of body. Excretory pore just anterior to vulva. Intestine simple; anus 77 to 120μ from posterior end of body. Tail conical. Vulva 215 to 230μ from anterior end of body; ovejector extremely long; unbranched part of uterus 2.5 to 3.5 mm. long; amphidelphic. Eggs 69 to 84μ long by 38μ wide, apparently without crest, lateral grooves present.

Host: "Barata selvagem" (wild cockroach).

Location: Presumably intestine.

Distribution: South America (Angra dos Reis, State of Rio, Brazil).

7. Protrellus phyllodromi (Basir, 1942) n. comb.

Synonym: Protrellina phyllodromi Basir, 1942.

Specific diagnosis: Protrellus:

Male: Unknown.

Female: 2.3 mm. long by 160μ wide. Cuticle striated only anterior to vulva. First annule 22μ wide, the following annules have a maximum width of 5μ; the width of annules regularly decreases till striations are

lost. Mouth surrounded by eight labiopapillae. Buccal cavity cylindrical, 15μ long by 10μ wide. Oesophagus 300μ long, consisting of an anterior corpus 210μ long by 32μ in maximum width, an isthmus not distinctly separated from the bulb, and a valvular bulb 65μ wide. Nerve ring 130μ from anterior end of body. Excretory pore immediately in front of the vulva, 150μ from the anterior end of body. Intestine with a slight anterior cardia. Anus 145μ from the posterior end of body. Uterus bifurcating at one third of the body length from the posterior end, one branch being directed posteriorly and the other turning at the start and being directed anteriorly; unbranched part of uterus 1.6 mm. long. Ovaries two, anterior directed posteriorly and reflexed anteriorly, posterior directed posteriorly but not reflexed. Eggs elongated elliptical, 75μ long by 35μ wide, without a crest, with two lateral grooves.

Host: Phyllodromia humbertiana Sause

Location: Intestine (rectum).

Distribution: North India (Aligarh).

Key to the Species of the Genus Protrellus

1. Eggs not bearing cuticular crest.....2
   Eggs bearing cuticular crest.....3

2. Adult females about 2.3 mm. long.....P. phyllodromi
   Adult females 5.5 to 7.8 mm. long.....P. galebi.

3. Vulva in region of oesophageal bulb...P. Hünckeli
   Vulva anterior to oesophageal bulb.....4

4. Vulva in middle of corpus.....P. australasiae
   Vulva in posterior region of corpus.....5

5. Adult females about 3.62 mm. long.....P. manni.
   Adult females between 3.4 to 6 mm. long.....6

6. Eggs with a lateral crest.....P. aurifluus
   Eggs with a crest at one pole.....P. aureus

DISCUSSION

The genus Protrellus was proposed by Cobb (34) for a worm from an Australian cockroach. His description was confined to a formula and was unaccompanied by any figures. Schwenk (70) added P. galebi to this genus. Galeb (44) had described a species, Oxyuris künckeli which was transferred to this genus by Travassos, (36), together with Oxyuris australasiae Pessoa and Correa, 1926. Chitwood (20) regarded Protrellus and its type species P. aureus Cobb, as a genus and species inquirenda in the sub-family protrelloidinae, and proposed a new genus, Protrellina, to accommodate not only all the other species which had been placed in Protrellus hitherto, but two additional new species. At the same time he remarked that "It is probable that this genus (Protrellina) is a synonym of Protrellus Cobb, 1920, but from Cobb's description of the oral region, and in the absence of figures, it is not possible at present to include Protrellus in the Thelastomatidae, to which group Protrellina belongs". However, the writer is of the opinion that there is no necessity of regarding Protrellus as a genus inquirenda and that it can safely be restored to the family Thelastomatidae. The genus Protrellina Chitwood, 1932, would therefore become a synonym of Protrellus Cobb, 1920.

LINSTOWIELLA GEN. NOV.

Generic diagnosis: Thelastomatidae:

Male: Unknown.

Female: With three little developed lips. Oesophagus about one-twelfth of the body length, consisting of a corpus and a posterior bulb. Tail distinctly filiform, about 22% of the body length. Vulva anterior to base of oesophagus. Eggs spindle shaped with a smooth shell, truncated at both ends.

Type species: Linstowiella lanceolata (Linstow, 1833) n. comb.

Linstowiella lanceolata (Linstow, 1833).

Synonyms: Oxyuris lanceolata Linstow, 1833.

Thelastoma lanceolata (Linstow, 1833) Travassos, 1929.

Specific diagnosis: Linstowiella:

Male: Unknown.

Female: 6.7 mm. long by 530µ wide. Head with three little developed lips, each of which carries a small papilla (?). Oesophagus 679µ long, consisting of an anterior corpus and a posterior spherical bulb. Tail distinctly filiform, 1.456 mm. long, becoming attenuated suddenly behind the anus, at first 60µ wide. Vulva anterior to base of oesophagus, 362µ from the anterior end

of body. Eggs spindle-shaped, with a smooth shell, truncated at both ends, 180μ long by 36μ wide.

Host: Insect. (Species not determined).

Location: Not given (Presumably intestine).

Distribution: Turkestan.

This genus differs from all other genera having their genital aperture anterior to base of oesophagus in possessing a filiform tail.

LEGENDS

Figure 12

(A-D) *Protrelloides paradoxa*

A. Female, anterior region.
B. Female, *en face* view.
C. Egg.
D. Male tail, lateral view.

(E-K) *Protrelleta floridana*

E. Female, oesophageal region.
F. Female, head end, magnified.
G. Female, tail.
H.
I. Eggs.
J. Male, oesophageal region.
K. Male tail, lateral view.

(L-Q) *Protrellus aurifluus*

L. Female, oesophageal region.
M. Female, *en face* view.
N. Female, tail
O. Eggs.
P. Male, oesophageal region.
Q. Male tail, lateral view.

(R-T) *P. manni*

R. Female, oesophageal region.
S. Female, tail.
T. Eggs.

(U) *P. australasiae*

U. Female, entire.

(V-W) *P. künckeli*

V. Female, entire.
W. Male, entire.

(X) P. galebi.

X. Female, entire.

(Y-Z) P. phyllodromi

Y. Female, entire.
Z. Egg.

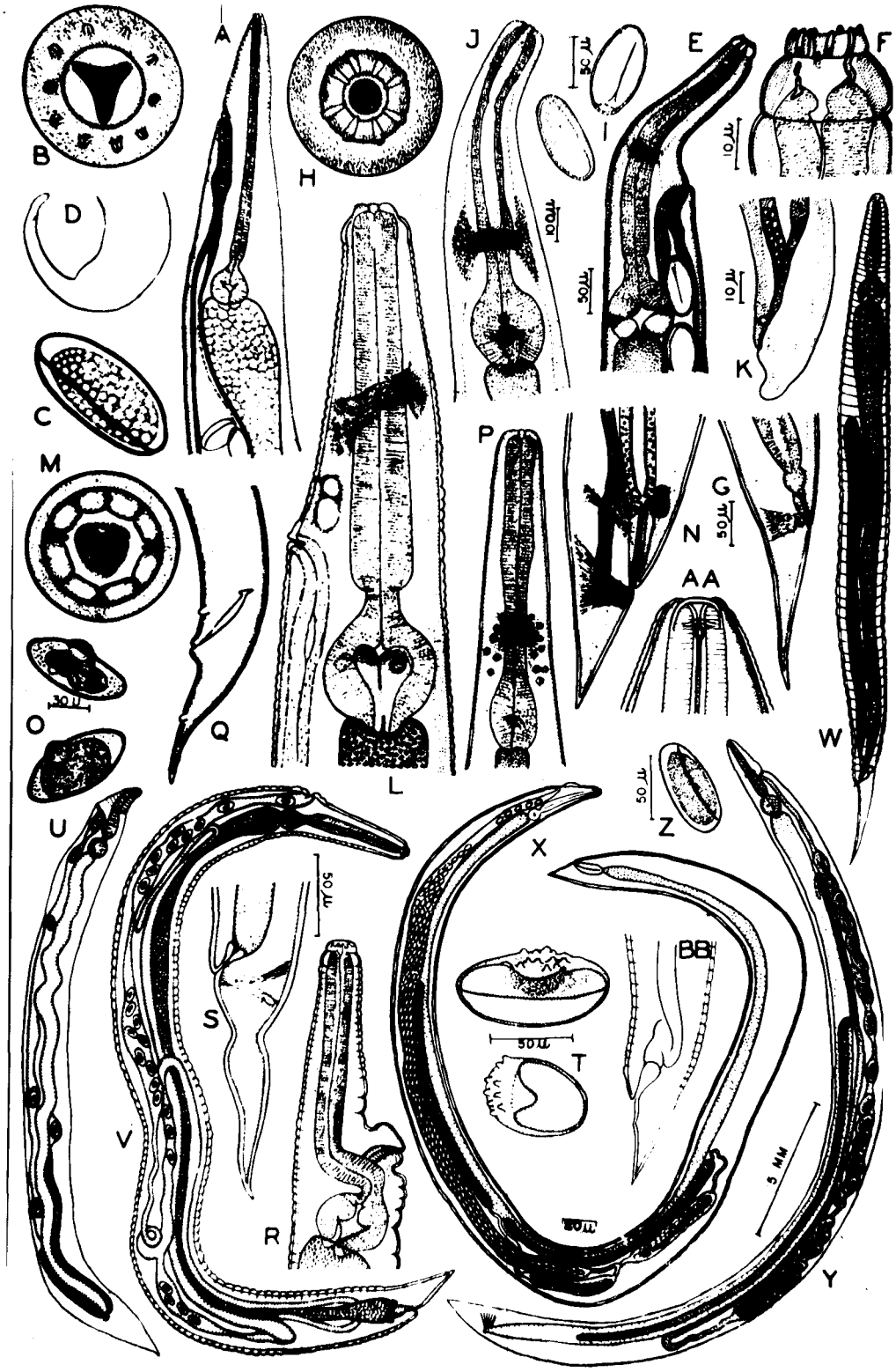
(AA) Binstoviella lanceolata

AA. Female, head end.

(BB) Oxyuris heterogaminae

BB. Female, tail.

(A-T after Chitwood (20); U after Pessoa and Correa (65); V-W after Galeb (44); X after Schwonk (70); Y-Z after Basir (9); AA after v. Linstow (53); BB after Galeb (44).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Y
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AA
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50 µ
100 µ
10 µ
5 MM

SPECIES INQUIRENDA

1. (?) Oxyuris heterogaminae Galeb, 1878, (Fig. 12, BB).

Synonym: Thelastoma heterogaminae (Galeb, 1878) Travassos, 1929.

Specific diagnosis:

Male: Unknown

Female: 2 to 2.5 mm. long with a conical tail.

Host: Heterogamia segyptiaca L.

Distribution: (?) Egypt.

Galeb (44) gave practically no description of this species except for its length and a single figure of its tail. He wrote "Nous n'avons vu de cette espece que des individus femelles qui avaient 2 a 2.5 mm. de longueur, et dont l'extremite caudaule affectait une forme toute particuliere provenant d'une Blatte egyptienne: l'Heterogamia aegyptiaca". This description is not enough to identify any particular species as there are many genera in the family Thelastomatidae which have this size and a conical tail. Chitwood (20) regarded it as a species inquirenda in the genus Thelastoma, remarking at the same time that "on the basis of the single figure it is certain that the species does not belong to the genus Thelastoma.

The genera of Blattidae to which it might possibly belong are Blatticola and Protrellina". The present author feels no justification in placing it with Thelastoma, and think that its proper place is as an appendix to the family Thelastomatidae. It would be possible to identify the species only after studying the nematodes from the same host.

2. (?) Oxyuris platyrhaci Parona, 1896, (Fig. 11, H-O).

Specific diagnosis:

Male: With general characters as in female, 2 mm. long by 280μ wide. Testis extending anterior to middle of body. One arcuate spicule shaped like a rose thorn with a basal dilatation, 84μ long.

Female: 3 mm. long by 250μ wide. Cuticle finely striated. Oesophagus 322μ long, consisting of a corpus and a globose bulb, 84μ in diameter. Tail filiform, forming about one third of the body length. Vulva a little behind the middle of body. Two ovaries, both anterior, arising in the oesophageal region. Oviduct forming a loop in the middle part of body. Eggs two layered, somewhat flattended on one side, 140μ long by 70μ wide, segmented before deposition.

Host: "Platyrhacus modiglianii Silv." (Diplopoda).

Location: Intestine.

Distribution: Sumatra (Indonesia).

3. (?) Oxyuris sumatrensis Parona, 1869, (Fig. 11, P-Q).

Specific diagnosis:

Male: Unknown.

Female: With body tapering sharply towards the posterior end; 4 mm. long by 500µ wide. Cuticle distinctly annulated, annules reaching a maximum length of 28µ. Oesophagus 560µ long, corpus slightly dilated, bulb globose, a little wider than the corpus. Tail filiform. Vulva anteri slightly behind the first quarter of the body.
The disposition of the reproductive organs could not be studied by the author due to numerous eggs filling the body completely and obscuring the view. Eggs with a yellowish tint, oval, 98µ long by 28µ wide, having a shell bearing cross striations.

Host: "Platyrhacus modiglianii".

Location: Intestine.

Distribution: Sumatra.

The description and figures given by Parona (63) for the two species described above superficially appear

to be sufficient enough for their diagnosis; in spite of that the present author feels that it is not possibl to assign them to any genus existing at present and it thought inadvisable to create new genera for them until a detailed and more reliable study is made from fresh material.

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II. FAMILY OXYURIDAE.

INTRODUCTION

All the oxyuroid parasites of arthropods were contained in the family oxyuridae until 1920 when Travassos (8) proposed the families Lepidonemidae and Isakidae to accommodate them. Later (9) he restricted the family Lepidonemidae to three genera only, namely Lepidonema Cobb, 1898, Hystrignathus Leidy, 1850, and Pulchrocephala Travassos, 1925; retained the previous status of the family Isakidae and placed all other oxyuroids of arthropods in a new family for which he proposed the name of Thelastomatidae. The family Oxyuridae was thus restricted to the oxyurids of vertebrates. Unfortunately, the separation of the families Thelastomatidae and Oxyuridae was not based on any morphological or biological grounds but only on the difference in the host. This was not a sound basis on which to separate two families.

Chitwood (5) gave an amended diagnosis of the family Thelastomatidae and pointed out that all true Thelastomatids which he was able to examine have eight cephalic papillae or labiopapillae, and that this was the only morphological character separating them from the Oxyuridae, which had only four cephalic papillae. However, there were many forms which were described by previous workers, the head structures of which were not thoroughly

studied. These also were placed in the family Thelastomatidae on the presumption that they would contain the required eight papillae.

In 1930, Chitwood (4) described a worm, Fontonema brachygaster, from a millepede which had three lips and four cephalic papillae which he referred to the family Oxyuridae. However, in the key to the genera of the family Thelastomatidae given by Chitwood and Chitwood in 1933 (6) this genus was also included. The present writer was informed verbally by Dr. Chitwood that he had done so because he had only two specimens at his disposal at the time of studying this worm and, as the papillae in question were minute, there was a possibility of some of these escaping observation.

The writer (3) in describing the male of Chitwoodiella ovofilamenta noticed that the head had only four papillae and expressed doubt as to the exact place of this genus. Later, while preparing the present revision, all the oxyuroids of Arthropods which could be had were thoroughly restudied, and it was found that not only Chitwoodiella but also the genus Mirzaiella possesses only four cephalic papillae.

Therefore, the writer has now transferred the genera Fontonema Chitwood, 1930, Chitwoodiella Basir, 1943, and Mirzaiella Basir, 1942, to the family Oxyuridae

where apparently they belong. One other worm, which was described by Skrjabin (7) from a millepede and the head structure of which was thoroughly studied by him, had three well developed lips and six papillae (presumably two of these would be amphids). Thus this species would also belong to Oxyuridae and for this a new genus, Desmicola, has been proposed.

FAMILY OXYURIDAE COBBOLD, 1864

Family diagnosis: Oxyuroidea: Mouth opening surrounded by three inconspicuous or conspicuous lips; bearing four double cephalic papillae of the external circle. Oesophagus always with a corpus which is not extremely short and a posterior valvular bulb. Male with a single spicule or none. Parasites of arthropods and vertebrates.

Type genus: Oxyuris Rudolphi, 1803.

Key to the Arthropod parasitic genera of Oxyuridae

1. Buccal cavity of female long and annulated -- Chitwood
~~1a~~.
   Buccal cavity of female short and without annulations.

2. Tail of female short, almost conical.....Virgaella
   Tail of female long and filiform--.....

3. Vulva near middle of body.....Fontonema
   Vulva near anus .....Desmicola

GENUS CHITWOODIELLA BASIR, 1948

Generic diagnosis: Oxyuridae: Mouth opening subtriangular, surrounded by a circumoral elevation bearing three distinct but very small lips, the dorsal lip bearing two very small subdorsal papillae and each ventrolateral lip one subventral papilla and one amphid. Buccal cavity very characteristic, long and annulated. Oesophagus long, occupying about one-fourth of the body length, and consisting of a long almost cylindrical corpus, a narrow isthmus and a bulb. Female tail attenuated filiform. Vulva between middle and posterior third of body. Vagina short, directed anteriorly. Two ovaries, both anterior, arising in the oesophageal region slightly behind the nerve ring; uteri divergent. Eggs elliptical, organically connected with each other and enveloped by filamentous threads arising in the form of a tuft from each pole, segmented before deposition and laid in the form of a chain. Male tail almost truncated, bearing distinct caudal alae. Caudal papillae five pairs; three pairs preanal and two pairs postanal, slightly pedunculated, the stalks being more distinct in the postanal papillae. In addition to caudal papillae a median ventral rod-like, bluntly pointed projection juts out backwards just behind the anus.

Type species: Chitwoodiella ovofilamenta Basir, 1948.

Chitwoodiella ovofilamenta Basir, 1948.

Specific diagnosis: Chitwoodiella:

Male: 1.3 to 1.48 mm. long. In the following description measurements are taken from a worm 1.33 mm. long by 110μ in maximum width. Body almost cylindrical, tapering anteriorly in the oesophageal region and posteriorly in the region of the tail. Mouth opening and buccal cavity as in female, the latter 30μ deep by 10μ in maximum width. Oesophagus 302μ long; corpus 232μ long by 20μ wide; isthmus 20μ long by 10μ wide; and bulb 50μ long by 45μ wide. Intestine only slightly dilated anteriorly. Anus 34μ from posterior extremity. Nerve ring 145μ from anterior end of body. Excretory pore near base of oesophagus, slightly posterior to it. Testis reflexed anteriorly, about 230μ behind oesophagus. Tail almost truncated, bearing distinct caudal alae; caudal papillae five pairs, three pairs precnal and two pairs postanal, the latter distinctly pedunculated, the stalks of precnal papillae being very short. Of the precnal papillae the first pair is ventral in position, about 70μ anterior to the anus; the second pair is also ventral and about 10μ from the anus. Of the postanal papillae the first pair

behind the anus is ventral and the second lateral in position. In addition, there is a median ventral rod-like bluntly pointed projection jutting out backwards from the tail just behind the anus, 12μ long.

Female: 1.11 to 2.15 mm. long by 200μ in maximum width.

Mouth opening sub-triangular, surrounded by a circumoral elevation and bearing three distinct but very small lips, the dorsal lip having two minute subdorsal papillae near its outer margin, and the ventro-lateral lips one subventral papilla and one lateral amphid each. Buccal cavity very characteristic, its anterior half being narrower and finely striated, its posterior half wider with comparatively few striae farther apart; anterior part of buccal cavity about 10μ wide, its posterior part about 18μ at its widest. Oesophagus 300μ to 475μ long; corpus cylindrical, 235 to 370μ long by 30μ in maximum width; isthmus 25 to 35μ long by 20μ wide; bulb 60 to 80μ long by 60 to 85μ wide. Nerve ring 105 to 130μ from the anterior end of body. Excretory pore could not be observed in spite of plenty of material. Intestine enlarged anteriorly to form a slight cardia, the latter,

being not much wider than the oesophageal bulb. Anus 150 to 200μ from the posterior end of body; tail attenuated filiform. Vulva salient with its anterior lip projecting outwards, 1.25 m.m. from the anterior end of body; vagina short and directed anteriorly. Two ovaries, both anterior, originating at the same level in the oesophageal region a little behind the nerve ring; uteri divergent. Eggs elliptical, organically connected with each other and enveloped by filamentous threads, the latter arising in the form of a tuft from each pole, segmented before deposition and laid in the form of a chain, 30μ long by 40μ wide.

DISCUSSION

Host: Gryllotalpa africana Beauv., Scapteriscus vicinus Scudder; (Gryllidae); "Virginicou" (Opossum).

Location: Intestine, (stomach of opossum)?.

Distribution: N. India, British West Indies.

The genus Chitwoodiella was originally placed (2) in the family Thelastomatidae due to an error in studying its head structures. Later (3) when the male of this worm was described, the writer expressed his doubts about the position of this genus, but left the matter undecided. Now after careful study it has been

ascertained that the head bears only four papillae and, therefore, the genus has been transferred from the family to which it was originally assigned to the family Oxyuridae to which it apparently belongs. An important point to note here is that the same species occurs in an invertebrate and a vertebrate host. Wolfgang (10) has recorded this species from an opossum from the British West Indies. It is probable that the vertebrate, which is insectivourous in its feeding habits, might have fed on mole crickets, which are commonly parasitized by this worm in the B.W.I.

GENUS FONTONEMA CHITWOOD, 1930

Generic diagnosis: Oxyuridae:

Male: Not known.

Female: With mouth opening sub-triangular, surrounded by three lips; the lips are not separated by deep indentations. Amphids are present on the dorsal sides of the sub-ventral lips. Papillae four. Cuticle coarsely striated from the anterior end to the anus. Head annule large and separated by a deep constriction. Buccal cavity with three intermediate thickenings of the cuticle which form small teeth. Excretory pore anterior to base of oesophagus, lying in the region of the posterior corpus. Tail filiform, forming about 30% of body length. Two ovaries; posterior ovary outstretched and directed posteriorly, its blind end nearly reaching the level of the anus; anterior ovary extending past the oesophageal bulb and reflexed at a point level with the excretory pore. Vulva near middle of body. Eggs oval.

Type species: Fontonema brachygaster Chitwood, 1930.

Fontonema brachygaster Chitwood, 1930.

Specific diagnosis: Fontonema:

Male: Not known.

Female: body coarsely striated from anterior region to anus, about 70 to 75 annulations in all. First annulation large and deep simulating a head. Mouth opening sub-triangular, surrounded by three equal lips, not separated by deep indentations. Dorsal lip with two papillae near its outer margin; each of the sub-ventral lips with a sub-ventral papilla on its ventral side and an amphid towards its dorsal side. Buccal cavity extending to the middle of the second segment. Onchia three, equal, small thickenings of the cuticle best seen in side view, somewhat covered in face view. Oesophagus long, occupying about 20% of body length, with an anterior cylindrical corpus and a posterior bulb. Intestine dilated anteriorly to form a distinct cardia. Tail slender and filiform, forming about 30% of body length. Anal and caudal glands present. Nerve ring located slightly anterior to the middle of the oesophagus (10 to 12% of body length from the anterior end). Excretory pore anterior to base of oesophagus, between the nerve ring and oesophageal bulb. Vulva at a distance of 45% of body length from the anterior end. Uteri amphidelphic. Two ovaries; anterior ovary extending past the oesophageal bulb and reflexed at a point about even with the excretory pore, the reflexed end short, terminating at level of the base

of oesophagus. Posterior ovary outstretched in the posterior part of body, its blind end reaching about the level of anus. Eggs oval, small, 24u long by 14u wide (size measured from the diagram given by Chitwood).

Host: Fontaria coriacea.

Location: Intestine.

Distribution: Washington (U.S.A.).

GENUS MIRZAIELLA BASIR, 1942

Generic diagnosis: Oxyuridae:

Male: Not known.

Female: Oral opening small and sub-triangular, surrounded by three well developed lips, one dorsal and two sub-ventral; the dorsal lip bearing two very small papillae and the sub-ventral lips one ventral papilla and one lateral amphid each. Buccal cavity formed of two distinct parts of almost equal size. Oesophagus occupying about one-fourth of body length, consisting of an anterior corpus shaped like an inverted club, an isthmus, and a valvular bulb. Intestine dilated anteriorly to form a cardia. Excretory pore anterior to base of oesophagus. Tail short and blunt, bearing a small caudal appendage of varying size. Vulva at two-thirds of body length. Vagina heavily built, long and muscular, directed anteriorly. Two ovaries, opposed. Eggs oval, bearing tufts of filaments at each pole, laid in mucous capsules, each capsule containing from one to three eggs.

Type species: Mirzaiella asiatica Basir, 1942

Mirzaiella asiatica Basir, 1942.

Specific diagnosis: Mirzaiella:

Male: Not known.

Female: 2.25 mm. to 2.93 mm. long. The following description is taken from a worm measuring 2.5 mm. in length by 40µ in maximum width. Cuticle striated only anterior to nerve ring; annules between 10 and 20µ apart. Mouth opening small and sub-triangular, surrounded by three well developed lips, one dorsal and two sub-ventral, the dorsal one bearing two minute papillae near its outer margin, each sub-ventral lip bearing a papilla on its sub-ventral side and an amphid laterally. Amphidial openings very minute and hard to see. Buccal cavity 25µ long by 25 to 30µ wide, formed of two distinctly separate parts of almost equal size. Oesophagus occupying about one-fourth of body length, 650µ long, consisting of a corpus which is broader in its anterior part and narrows gradually towards the bulb giving it the shape of an inverted club, 500µ long by 55µ wide anteriorly and 30µ wide posteriorly; isthmus 10µ long by about 30µ wide, and bulb 110u long by 120µ wide. Nerve ring 290µ from anterior end of body. Excretory pore slightly anterior to oesophageal bulb, about 560µ from anterior extremity. Intestine dilated anteriorly to form a distinct cardia. Anus 200µ from posterior extremity. Tail short and blunt, bearing a small caudal appendage, the length of the latter varying

with age; in older worms appearing as a small knob at the tip of the tail, and being much longer in younger forms. Vulva at two-thirds of body length, 1.67 mm. from the anterior end of body. Vagina long, muscular and of heavy build, directed anteriorly. Two ovaries, anterior ovary arising in the region of oesophagus behind the nerve ring, posterior ovary reaching the region of the anus or even extending posterior to it; both ovaries reflexed. Uteri divergent; each set of reproductive organs forming about four loops. Eggs oval, 66 to 70μ long by 42 to 45μ wide, bearing tufts of polar filaments and laid in mucous capsules, each capsule containing from one to three eggs; the size of the capsule depending on the number of eggs enclosed in it; passed unsegmented or sometimes in two-celled stage.

Host: Gryllotalpa africana Beauv.

Location: Posterior intestine.

Distribution: N. India.

DISCUSSION

The genus Mirzaiella was originally placed by the writer in the family Cholastomatidae (1) due to an error in studying the head papillae. However, it has now been transferred to the family Oxyuridae, where it

apparently belongs. It should however be noted that except for its head structures, there is nothing else to distinguish it from the genus Binema, both having a very similar disposition of the reproductive organs and in both the eggs having exactly the same structure (including filaments) and even being passed out in the same way, enclosed in mucous capsules. These worms might represent the stage where the Thelastomatids have evolved into oxyurids.

DESMICOLA NEW GENUS

Synonym: Oxyuris Rud., 1803 (in part).

Generic diagnosis: Oxyuridae:

Male: Not known.

Female: Body spindle shaped; cuticle conspicuously annulated. Lateral alae present, commencing behind the oesophageal corpus and extending to the region of the anus. Head modified to form a crown-like structure in the form of an inflated head annule. Mouth surrounded by three well developed lips of equal size, each lip being divisible into two parts, an upper part bearing two papillae and a lower part also bearing two papillae (?). Between every two adjacent lips is a small cuticular outgrowth. Oesophagus occupying about one-sixth of the body length and consisting of a corpus, an isthmus and a valvular bulb. Intestine dilated anteriorly to form a pronounced cardia. Tail filiform, forming a little less than half of body length. Excretory pore anterior to base of oesophagus, lying at about the level of the isthmus. Vulva near anus, slightly anterior to it. Eggs oval. Ovaries (presumably) two.

Type species: Desmicola leidyi (Sharjabin, 1916) nihi.

Desmicola leidyi (Sharjabin, 1916) nihi.

Specific diagnosis: Desmicola:

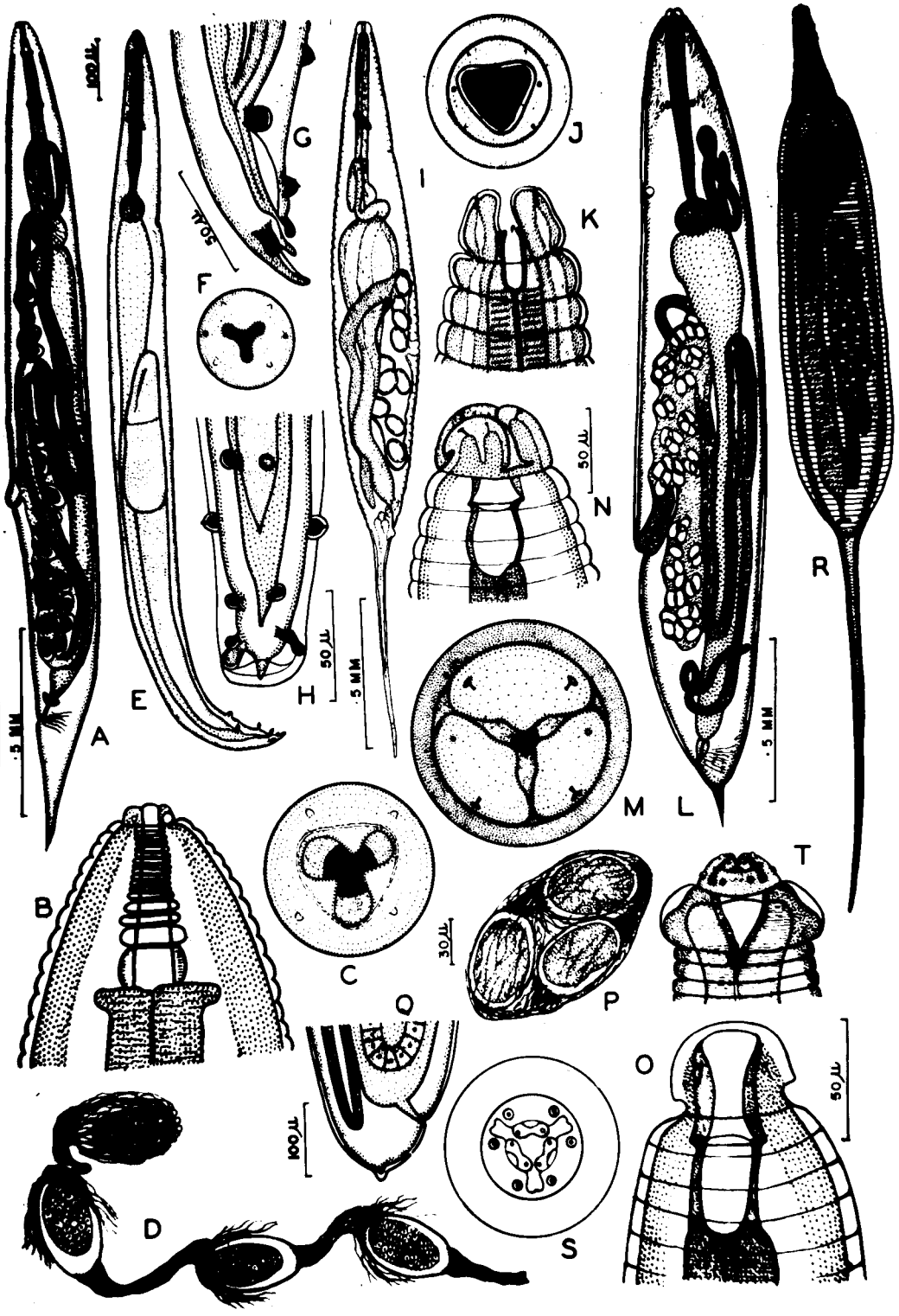
Male: Not known.

Female: Body spindle shaped, 2.465 m.m. long by 255u in maximum width. Cuticle distinctly annulated throughout the whole length of body. Lateral alae conspicuous, commencing in the region of oesophageal isthmus and extending to the level of anus. Head modified to form a crown-like structure in the form of an inflated head annule, the latter being about four times the size of the following annules. Mouth surrounded by three well developed lips, separated from each other by deep grooves, each lip being composed of two parts, an upper and a lower, bearing two papillae each (?). Each interlabial groove having a cuticular outgrowth very similar to the interlabia of Ascaridae. Oesophagus 425μ long consisting of a corpus, an isthmus and a valvular bulb; corpus 40μ wide and bulb with a diameter of 35 to 90μ. Intestine dilated anteriorly to form a pronounced cardia. Anus 1.105 m.m. from the tip of tail; tail filiform, constituting a little less than half the body length. Excretory pore anterior to base of oesophagus, in the region of isthmus. Vulva near anus, slightly anterior to it. Ovaries presumably two. Eggs oval, about 35μ long by 51μ wide.

Host: *Polydesmus* sp. (Myriapoda).

Location: Intestine.

Distribution: British East Africa.



For LEGENDS please see next page.

LEGENDS

Figure 1

A-H Chitwoodiella ovofilamenta.

A. Female, entire.
B. Female, head end, magnified.
C. Female, en face view.
D. Chain of eggs as passed out.
E. Male, entire.
F. Male, en face view.
G. Male, tail, lateral view.
H. Male, tail, ventral view.

I-K Fontonema brachycaster.

I. Female, entire.
J. Female, en face view
K. Female, anterior end.

L-Q Mirzaiella asiatica

L. Female, entire.
M. Female, en face view
N. Female, anterior end.
O. Female, buccal cavity.
P. Egg capsule.
Q. Female, tail (not usual shape).

R-T. Desmicola leidyi.

R. Female, entire.
S. Female, en face view.
T. Female, anterior end.

(I-K after Chitwood, 1930; R-T after Khorjabi 1916; remainder original).

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III. FAMILY RHIGONEMATIDAE.

INTRODUCTION

The family Rhigonematidae (Rhigonemidae) was proposed by Artigas (5) to contain the genera Rhigonema Cobb, 1898, Dudekemia Artigas, 1930, and Icthyocephalus Artigas, 1925, In 1920 Travassos had proposed the family Isakidae to accommodate the genus Isacis Léspes, 1856 into which were later placed almost all the nematodes having some resemblance to the genus Rhigonema Cobb. Christie and Cobb, 1927 pointed out that true Rhigonema-like nematodes should not be placed in the genus Isacis which has quite different characters, and suggested that the generic name Isacis be dropped. Artigas (4) proposed the division of the family Isakidae into two sub-families, namely, Isakinae to contain the genus Isacis, and Icthyocephalinae to contain the genus Icthyocephalus. Later Artigas (5) replaced the name Isakidae with Rhigonematidae, as the name of type genus was changed from Isacis to Rhigonema; consequently the name Isakinae was dropped in favour of Rhigonematinae.

FAMILY RHIGONEMATIDAE ARTIGAS, 1930

Synonym: Isakidae Travassos, 1919

Family diagnosis: Oxyuroidea: Mouth surrounded by two or three well developed lips, bearing four double papillae of external circle; amphids present. Oesophagus very short, consisting of an anterior corpus and a posterior valvular bulb, distinctly separated from the corpus by a constriction; isthmus not distinct. Two ovaries; uteri divergent. Male with two almost equal spicules; gubernaculum absent. Parasites of Myriapods.

Type genus: Rhigonema Cobb, 1898.

Key to the subfamilies of the family Rhigonematidae

Mouth surrounded by three lips..... Rhigonematinae
Mouth surrounded by two lips .....Ichthyocephalinae

SUBFAMILY RHIGONEMATINAE ARTIGAS, 1930

Synonym: Isakinae Artigas, 1929.

Subfamily diagnosis: Rhigonematidae: Mouth opening surrounded by three well developed and highly cuticularized lips bearing dentations on their inner sides. Cephalic papillae four, two on the dorsal lip and one on each subventral lip; amphids present, one on each subventral lip. Oesophagus very short;

17. A description of the male of Chitwoodiella ovofilamenta Basir, 1948. Proc. Helmin.Soc. Washington., 16(2): 112-114, 1949.

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corpus almost as broad as the bulb; isthmus not distinct. Vulva near middle of body. Two ovaries. Male with two spicules; gubernaculum absent.

Type genus: Rhigonema Cobb, 1898.

GENUS RHIGONEMA COBB, 1898

Synonym: Isacis Lespes, 1856 (in part).

Generic diagnosis: Rhigonematidae:

Cuticle exceedingly finely striated, sometimes with exceedi minute retrorse bristles, especially in the anterior region of body. Body subtruncate anteriorly. Oral opening surrounded by three well developed lips. Buccal cavity very small, and armed in front with three onchia. Cephalic papillae four; amphids present in the same circlet as the papillae. Oesophagus consisting of an anterior corpus and a bulb distinctly set off by definite constriction. Corpus broad with an almost indistinct swelling in its anterior part. Interior part of corpus surrounded by a circlet of glands. Intestine dilated anteriorly to form a cardia, broader than the oesophageal bulb. Excretory pore in the region of the bulb, anterior to its base. Tail almost conical. Vulva slightly posterior to middle of body. Two ovaries, opposed; uteri divergent; vagina long and muscular, with a large muscular syringate bulb-like outgrowth opening into it. Eggs numerous; ellipsoidal; segmentation starts before laying. Male with a conical tail, without any bursa, bearing five pairs of subventral preanal, one ventral unpaired preanal in front of the anus, and four pairs of postanal caudal papillae; two

equal slightly arcuate spicules; no gubernaculum. Testis reflexed anteriorly.

Type species: Rhigonema infectum (Leidy, 1849) (Fig. 1, A-K) Christie and Cobb, 1927.

1. Rhigonema infectum (Leidy, 1849) Christie and Cobb, 1927.

Synonyms: Ascaris infecta Leidy, 1849.

Isacis infecta (Leidy, 1849) Diesing, 1861.

Rhigonema brevicolle Cobb, 1898.

R. nicolla Thomas, 1930.

Specific diagnosis: Rhigonema.

Male: 3.2 to 4.353 mm. long. The following measurements are from a worm measuring 4.35 mm. in length and 150u in maximum width. Cuticle with exceedingly fine striations and in addition minute retrorse bristles which fade out on one side laterally and disappear entirely midway of the body. Structure of head, oesophagus, position of excretory pore similar to that of the female. Testis reflexed. Tail conical, 130u long, without any bursa, bearing five pairs of precnal subventral papillae a single unpaired precnal papilla just in front of the anus, and four pairs of postanal papillae. Two equal, slightly arcuate spicules, each 427u in length; gubernaculum absent.

Female: 6.3 to 9.5 mm. long. The following measurement are from a worm 6.463 mm. long by 150u in maximum width. Body almost cylindrical with a subtruncate anterior end. Cuticle bearing exceedingly fine transverse striations, and in addition minute retrorse bristles covering almost the whole body to the anal region. Mouth subtriangular surrounded by three flat, thin lips. Cephalic papillae four; amphids present in the same circle as papillae. Buccal cavity small, armed in front with three broad, lobed, and denticulate onchia. Oesophagus short and broad, 220u long, consisting of a corpus, 150u long by 55u in maximum width bearing an almost indistinct pharyngeal swelling and a highly muscular bulb separated from the corpus by a distinct constriction, about 60u long by 70u wide. Intestine dilated anteriorly to form a cardia much broader than the bulb. Nerve ring in the middle of oesophagus, 110u from the anterior extremity. Excretory pore slightly anterior to base of oesophagus. Anus 130u from tip of tail; tail almost conical or conically attenuated. Vulva at 57% of body length; 3.7 mm. from the anterior end. Two ovaries, opposed; both reflexed and arising in the region of the vulva; uteri divergent; vagina long and muscular, receiving in addition to the uteri a large oblong muscular-walle

saccate structure regarded as a spermatheca by Artigas (5). Eggs numerous, ellopsoidal, 67u long by 44u wide.

Host: Julus marginatus Say; Parajulus dux; (both Myriapoda).

Location: Intestine.

Distribution: U.S.A., Australia.

Leidy's (11) species is almost identical with Rhigonema brevicolle Cobb, and accordingly, the type species of the genus should be called R. infectum in place of Cobb's name. Thomas (17) described another species, R. nigella, which also appears to be the same as Leidy's species and thus becomes a synonym of the type species.

2. Rhigonema truncatum Artigas, 1926. (Fig. 1, L-O).

Specific diagnosis: Rhigonema:

Male: 3.6 to 5.1 mm. long by 270 to 300u in maximum width. Oesophagus with a corpus 290 to 340u and a bulb 100 to 150u long. Excretory pore 360u from anterior end of body. Anus 110u from posterior extremity; tail conical bearing eleven pairs of papillae; eight pairs preanal and three pairs postanal (?). Two equal arcuate spicules, each 290 to 330u long; gubernaculum absent. Testis reflexed about a milimeter behind the base of the oesophagus.

Female: 4.7 to 5.1 mm. long by 300 to 370u in maximum width. Oesophagus with corpus 310 to 330u long and bulb 90 to 120u in length. Nerve ring 140u from anterior end of body. Anus 140 to 150u from posterior extremity; tail conical. Vulva 2.45 to 2.65 mm from anterior end, slightly behind the middle of body. Two ovaries, opposed, both arising near middle of body; uteri divergent. Vagina long and muscular, receiving in addition to the uteri, a muscular, saccate "spermatheca" which lies anterior to it. Eggs comparative few, ellipsoidal, 34u long by 61u wide.

Host: Myriapod.

Location: Intestine.

Distribution: Sao Paulo (Brazil).

This species differs from the type species in the nuber of papillae on the tail of the male and in possessing larger eggs. There is a possibility that the fourth pair of postanal papillae and the single unpaired preanal papilla might have escaped observation.

Key to the Species of the genus Rhigonema

1. Eggs 67u long by 44u wide; male caudal papillae, 5 pairs preanal, single unpaired preanal and four pairs postanal..... R. infectum

2. Eggs 34u long by 61u wide; male caudal papillae, 3 pairs preanal and 3 pairs postanal....R. truncatum

DISCUSSION

Cobb in 1898 (8) proposed the genus Rhigonema for a worm from a millepede which he called R. brevicaudatum. A very similar worm had been described from the same host by Leidy in 1849 (11) as Ascaris infecta and in 1859 d'Udekem (20) also described a worm resembling both the above forms under the name of Rhabditis acuminata. Both the latter species were referred by Diesing in 1861 (9) to the genus Isacis Lespes, 1856, with a number of other species of doubtful position. These were:

Isacis cuspidata (Rudolphi, 1814) (= Ascaris cuspidata)

I. gryllotalpae (Dufour, 1837) (= Cucuris gryllotalpae)

I. ascaris Diesing, 1860 (= Ascaris stein)

I. lucani (Froelich, 1802) (= Ascaris lucani)

I. nigrans Lespes, 1856.

I. cylindrica (Leidy, 1856) (= Ascaris cylindrica)

I. macrocephala (d'Udekem, 1859) (= Rhabditis macrocephala)

I. nigrans Lespes, 1856, the type species of the genus is, according to its author (13), a temporary parasite of termites, and is also capable of living free in the soil. Its description is insufficient to assign it to any genus. At least one thing which is clear from

Lespes' diagrams is the presence of an accessory piece, which would preclude the possibility of placing it with the Rhigonema of Cobb and, therefore, as Christie and Cobb (7) have suggested, the genus Isacis should be abandoned. Ascaris cylindrica Leidy is a species from a snail. Its description also is insufficient and is not accompanied by any figures. It could possibly belong to another group of nematodes altogether. Artigas (5) suggested that I. macrocephala (d'Udekem) should be transferred to the genus Ransomnema Artigas, 1926. The present author feels that I. cylindrica, I. gryllotalpae, I. luc are not described well enough to be placed anywhere with any certainty. From among the species assembled by Diesing in the genus Isacis, only Isacis infecta and I. acuminata possess true rhigonematid characters.

Parona (14) described two species of Isacis, I. silvestrii, and I. modiglianii, fro millepedes but his figures are diagramatic and his descriptions short and inadequate; moreover he has shown only one spicule in the male while all the other rhigonemas described so far have two. Skrjabin (16) added another species, I. multipapillata which is accompanied by a clear description and adequate diagrams.

Baylis and Daubney (6) also considered Rhigonema as a synonym of Isacis probably taking Skrjabin's descript

for the generic diagnosis. Christie and Cobb (7) proposed that the name Isacis should be given up because "the characters he (Lespes) gave do not adequately define either a species or a genus" and that "it is very manifest that Diesing's 'Isacis Lespes' designates a practically meaningless collection of either unrecognizable or incompatible forms." These authors retained the identity of the genus Rhigonema and placed in it four species, Ascaris infecta Leidy, Rhabditis acuminata d'Udekem, Rhigonema brevicolle Cobb, and Isacis multimpillata Skrjabin. Christie and Cobb (7) considered that "Parona's Isacis podicliannii, 1896, may perhaps prove to be a rhigonema."

Artigas (2) described three new species from myriapodes and placed two in the genus Isacis as I. falcatum and I. subulatum and one in the genus Rhigonema as R. truncatum. He distinguished the two genera by the absence of a "vesicula seminal" in Isacis and its presence in Rhigonema. The same author in 1930 agreed with Christie and Cobb (7) in giving up the name of Isacis and proposed a new genus, Dudekenia, to contain all rhigonemas without a "spermatheca" and to retain all with a "spermatheca" in the genus Rhigonema. This left in the latter genus only three species, Ascaris infecta, Rhigonema brevicolle, and R. truncata. Thomas (17) added another

species under the name of *R. nigella*. The present author feels that *Ascaris infecta*, *R. brevicolle*, and *R. nigella* are identical and this genus should contain only two species, *R. infectum*, the type species and *R. truncata*.

LEGENDS

Figure 1

A-K *Rhigonema infectum*

A. Female, entire.
B. Female, *en face* view.
C. Female, oesophageal region.
D. Female, anterior end, magnified.
E. Female, T.S. oesophagus.
F. Female, tail.
G. Female, reproductive organs.
H. Egg.
I. Male, tail, lateral view.
J. Male, tail, ventral view.
K. Spicule.

L-O *L.truncatum*

L. Female, entire.
M. Female, region of vulva.
N. Male, entire.
O. Male, tail, ventral view.

(A and F after Leidy, 1853; B, D, E, H, J, K after Thomas 1930 C, G, I after Chitwood and Chitwood, 1937; L-O after Artigas, 1926, 1930.)

A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
50 µ
200 µ
100 µ
200 µ
50 µ
200 µ
100 µ
200 µ

GENUS DUDEKEMIA ARTIGAS, 1930

Synonyms: Rhabditis Dujardin, 1845 (in part);
Isacis Lespes, 1856 (in part);
Rhigonema Cobb, 1898 (in part);
Haplacis Railliet and Henry, 1916.

Generic diagnosis: Rhigonematinae: Cuticle bearing transverse striations specially in the anterior region of body. Mouth surrounded by three well developed and highly cuticularized lips bearing dentations towards their inner borders. Buccal cavity short. Oesophagus as in the genus Rhigonema, consisting of an anterior claviform corpus and a valvular bulb. Excretory pore anterior to base of oesophagus. Vulva near middle of body; two ovaries, opposed; uteri divergent opening directly into a long muscular vagina. "Spermatheca" absent. Male with single testis; two equal spicules; gubernaculum absent.

Type species: Dudekemia multispinosa Artigas, 1930.

1. Dudekemia multispinosa Artigas, 1930. (Fig. 2, 1-6).

Specific diagnosis: Dudekemia.

Male: Like as female in general structure but smaller. The following measurements are from a worm 2.253 mm. long by 230u wide. Oesophagus 250u long; bulb 30u long by 70u wide. Anus 170u from tip of tail;

tail almost conical. Caudal papillae six pairs; three pairs precnal and three pairs postanal. Two equal arcuate spicules, each about 160u long.

Female: 2.65 to 3.73 mm. long. Cuticle transversely striated bearing numerous spines disposed in transverse rows and extending to the level of the excretory pore. Mouth opening surrounded by three well developed and highly cuticularized lips, one dorsal and two subventral, bearing dentations on their inner sides. Buccal cavity very short. Oesophagus 250 to 290u long, consisting of an anterior corpus differentiated into two parts and a posterior highly muscular and valvular bulb 30u long by 80 to 100u wide. Excretory pore near base of oesophagus, slightly anterior to it. Anus 330u from posterior end of body; tail attenuated. Vulva 1.24 to 1.6 mm. from the anterior end of body. Two ovaries, opposed; uteri divergent opening directly anteriad, then reflexed and runs posteriorly to the vulva. Eggs comparatively few; segmentation starts in uterus sometimes eggs being laid in the morula stage. Eggs 72 to 73u long by 54 to 62u wide.

Host: Myriapod.

Location: Intestine.

Distribution: Rio de Janeiro (Brazil)

2. Dudekenia acuminata (d'Udekem, 1859) Artigas, 1930. Fig. 2, H.J.).

Synonyms: Rhabditis acuminata d'Udekem, 1859;

Isacis acuminata (d'Udekem, 1859) Diesing, 1861;

Rhigonema acuminata (d'Udekem, 1859) Christie and Cobb, 1927.

Specific diagnosis: Dudekenia:

Male: Similar to females in general structure. Tail attenuated, not conical. Single testis; two spicules; caudal papillae five pairs preanal and three pairs postanal.

Female: 7.5 m.m. long by 100u wide. Cuticle striated transversely. Mouth opening surrounded by three cuticularized lips. Oesophagus consisting of a clavifom corpus and a valvular bulb. Tail attenuated. Vulva near middle of body. Two ovaries; uteri divergent opening directly into a long vagina.

Host: Julus terrestris (Myriapoda)

Location: Intestine.

Distribution: Europe.

3. Dudekenia multipapillata (Skrjabin, 1916) Artigas, 1930, (Fig. 2, H-K).

Synonyms: Isacis multipapillata Skrjabin, 1916;

Rhigonema multipapillata (Skrjabin, 1916) Christie and Cobb, 1927.

Specific diagnosis: Dudekenia:

Male: General structure same as in female. 3.57 mm. long by 137u in maximum width. Oesophagus 420u long, corpus 300u long by 140u wide; bulb 120u long by 140u wide. Anus 153u from tip of tail; tail almost conical, bearing a short caudal appendage about 50u long. Two long, equal and arcuate spicules, each 400 to 410u in length; gubernaculum absent. Caudal alae 15 pairs; nine pairs preanal and six pairs postanal arranged as follows; first and second pair slightly anterior to anus and close to each other, slightly anterior to these are the third, fourth and fifth pairs in a group and near each other, and further anterior lie the sixth, seventh, eighth and ninth pair equidistant from each other. Out of the postanal papillae, first, third and fifth pairs posterior to anus are lateral in position while the second, fourth and sixth are more or less ventrally situated.

Female: Body almost cylindrical, narrowing slightly near both ends; anterior end more or less truncate and bluntly rounded, 5.1 mm. long by 255u in maximum width. Mouth opening limited by three flat lips and surrounded by 6 undulating cuticular formations which constitute a shallow cavity (buccal cavity) at the bottom of which are arranged 3 chitinous irregular

triangular plates surrounding the entrance to the oesophagus, each with an exterior edge, the base by which the plate is attached to the underlying tissues, and an interior cover edge turned towards the oral aperture, the latter edge being covered with several large, sharp chitinous denticles and a series of minute ones giving this organ the aspect of a comb. Each lip bears 3 peg-shaped processes, some being bidentate. Interior surface of each lip covered with several rows of denticles. Oesophagus 476u long, consisting of a corpus 326u long by 170u in maximum width at its base, shaped like a truncated cone, with its base almost as wide as the bulb, the bulb being 150u long by 170u wide. Excretory pore slightly anterior to base of corpus. Anus 130u from posterior end of body; tail conical, provided with a short pointed appendage. Vulva between middle and posterior third of body, 3.1 m.m. from the anterior end. Two ovaries; opposed; uteri divergent. Eggs large, comparatively few, ellipsoidal, 102u long by 80u wide; segmentation starts in uterus.

Host: Julus Sp.

Location: Posterior intestine.

Distribution: East Africa.

4. Dudekemia falcata (Artigas, 1926) Artigas, 1930. (Fig. 2, N-O).

Synonym: Isacis falcatum Artigas, 1926.

Specific diagnosis: Dudekemia:

Male: 4.7 to 5.5 mm. long by 270u in maximum width. Cuticle striated transversely. Oesophagus 420 to 430u long; corpus 330 to 350u long and bulb 90 to 130u long. Nerve ring 130u from anterior end of body. Anus 230 to 290u from tip of tail; tail ending in a fair sized filamentous appendage. Two almost equal, recurved spicules, bearing at their distal ends a "wing-like" structure, each 110u in length. Caudal papillae 7 pairs; 4 pairs preanal and 3 pairs postanal.

Female: (Description common to two species, D. falcata, and D. subulata). 5.4 to 7.4 mm. long by 250 to 300u wide. Cuticle transversely striated. Mouth opening surrounded by three lips, each lip bearing an external cuticular outgrowth, the lateral margins of which are serrated. Cephalic papillae four, two on the dorsal lip and one each on each subventral lip. Buccal cavity containing three triangular denticulated structures. Oesophagus 430 to 530u long; bulb 30 to 110u in length. Nerve ring at about the middle of corpus. Excretory pore near base of corpus, 360 to 400u from anterior end of body. Anus 600u to 1 mm.

from posterior extremity, tail attenuated filiform. Vulva at about middle of body, 2.3 to 4.6 mm. from the anterior end. Two ovaries, opposed; uteri divergent. Ovejector long, directed anterior and not reflexed. Eggs more or less ellipsoidal, few in number, and 69u long by 53u wide.

Host: Myriapod.

Location: Intestine.

Distribution: Sao Paulo and Manguinhos (Brazil).

5. Duddingtonia subulata (Artigas, 1926) Artigas, 1930. Fig. 2, F).

Synonym: Isaacis subulatum Artigas, 1926.

Specific diagnosis: Duddingtonia:

Male: General structure same as in D. falcata. 5.3 to 7 mm. long by 250 to 300u in maximum width. Oesophagus 500u long; corpus 400u long and bulb 100u in length. Anus 600u from posterior extremity, tail attenuated. Two long and equal spicules, not bearing any "wing-like" structures at their distal ends as in the previous species, each 690 to 730u in length. Caudal alae 9 pairs; 4 pairs preanal and 5 pairs postanal.

Female: Similar to that described for D. falcata.

Host: Myriapod.

Location: Intestine.

Distribution: Rio de Janeiro (Brasil).

6. Dubelka ia robusta (Walton, 1927) Artigas, 1930. (Fig. 3, A-D).

Synonym: Isacis robusta Walton, 1927.

Specific diagnosis: Dudekemia:

Male: 3.9 to 4.1 mm. long by 200 to 250u in width. Corpus 150 to 160u long. Anus 70 to 75u from tip of tail; tail very short and conical. Two equal and arcuate spicules, each 325 to 330u in length. Accessory piece small and poorly cuticularized. Caudal papillae 9 pairs; 4 pairs preanal, and one pair adanal, and 4 pairs postanal; the posterior pair of the postanal group lateral in position, all other pairs being subventral.

Female: 7 mm. in average length by 450u in width. Mouth surrounded by three lips. Oesophagus 250 to 263u long; corpus 160 to 170u and bulb 90 to 93u long. Nerve ring 85 to 90u from anterior end of body. Anus 125 to 130u from posterior extremity; tail short, suddenly narrowing behind anus into a short spine-like structure. Vulva at about middle of body, 3.9 to 4.0 mm. from the anterior end. Two ovaries; opposed; uteri divergent, opening into a vagina which is reflexed anteriad. Eggs

sub-spherical, 70u long by 60u wide; segmentation starts before laying.

Host: Presumably a myriapod. (Walton (21) found these worms in a tube from Leidy's collection labelled from a cockroach; but no member of this family has yet been reported from any member of the family Blattidae).

Location: Presumably intestine.

Distribution: U. S. A.

7. Dudekemia brevicaudata Artigas, 1930. (Fig. 3, E-H).

Specific diagnosis: Dudekemia:

Male: 2.34 mm. long by 90u in width. Oesophagus 250u long; bulb 90u to 110u in width. Anus 30u from posterior extremity; tail conical bearing a very small caudal appendage. Two slightly arcuate spicules, characteristic in presenting in their middle thirds a reticular network, each 230u in length. Caudal papillae 4 pairs preanal, one median, and 4 pairs postanal, some of these difficult to observe. Rudimentary caudal alae present.

Female: 3.2 to 3.31 mm. long by 130 to 200u wide. Cuticle transversely striated, bearing spines in the anterior region which extend to about the level of the middle of the oesophagus. Mouth opening surrounded by three highly cuticularized lips, the inner edges of

which are serrated or bear dentations. Oesophagus 250 to 320u long; bulb 30u long by 120u wide. Excretory pore near base of corpus. Nerve ring in the anterior part of the oesophagus. Anus 70u from posterior extremity; tail short and conical, bearing a small filamentous caudal appendage. Vulva at about middle of body, 1.2 to 1.3 mm. from the anterior end. Two ovaries, opposed; uteri divergent. Ovejector long and reflexed anteriorly. Eggs 30 to 31u long by 52 to 64u wide.

Host: Myriapoda.

Location: Intestine.

Distribution: Rio de Janeiro (Brazil).

This species is very similar to D. robusta Walton (21), but is distinguished from it by the presence of slight caudal alae in the male, by the characteristic reticular network in the middle third of the spicules and by the presence of the spines in the anterior region of the body of the female.

3. Dudekemia inermis Artigas, 1930. (Fig. 3, I-J).

Specific diagnosis: Dudekemia:

Male: 4.47 to 7.23 mm. long by 210u wide. Oesophagus 330 to 360u long; bulb 30u long by 120u wide. Anus 310 to 340u from posterior extremity; tail attenuated filiform. Two almost equal spicules bearing

lateral wings in their proximal two thirds, each 130 to 240u in length. Caudal papillae 4 pairs preanal, one pair median, and 7 pairs postanal, some of these are difficult to observe.

Female: 5.39 to 6.9 m.m. long by 180 to 210u in width. Cuticular spines absent. Mouth surrounded by three highly cuticularized lips, each bearing two papillae (presumably two of these papillae are amphids). Oesophagus 280 to 310u long; bulb 120 to 140u long by 80 to 120u wide. Excretory pore level with the base of oesophagus. Anus 490 to 510u from posterior extremity; tail almost filiform. Vulva 2.1 to 3.1 m.m. from the anterior end of body. Two ovaries; opposed; uteri divergent. Eggs 72 to 76u long by 56 to 59u wide.

Host: Myriapoda.

Location: Intestine.

Distibution: Rio de Janeiro (Brazil)

SPECIES INQUIRENDA

1. (?) Dudekemia silvestrii (Parona, 1896) n. comb. (Fig. 3, K-N).

Synonyms: Isacis silvestrii Parona, 1896.

Haplacis (Isacis) silvestrii (Parona, 1896) Railliet and Henry, 1916

Specific diagnosis: (?) Dudekemia:

Male: 4 mm. long by 168u wide. Cuticle without any striations. Body tapering posteriorly. Mouth surrounded by three lips. Oesophagus 324u long consisting of a broad corpus, 140u wide, and a posterior spherical bulb, 84u in diameter. Intestine as wide as the bulb at its commencement. Anus 56u from posterior extremity. Testis extending to about the middle of body, slightly looped. One (?) very large, slightly arcuate spicule with a knob-like proximal end, 210u in length. Caudal papillae observed, 3 pairs preanal (?).

Female: 5 mm. long by 210u in width. Cuticle without striations. Body truncated anteriorly and narrowing in the posterior part. Anus 238u from posterior extremity. Vulva at middle of body. Two ovaries, one commencing a little behind the base of the oesophagus and the other slightly posterior to the genital aperture. Eggs oval, 72u long by 42u wide, segmented before deposition.

Host: "Platyrhacus modiglianii Silv."

Location: Intestine.

Distribution: Sumatra (Indonesia).

2. (?) Dudekemia modiglianii (Parona, 1896) n. comb. (Fig. 3, C-3).

Synonyms: Isacis modiglianii Parona, 1896;

Heterocis (Isacis) modiglianii (Parona, 1896) Railliet and Henry, 1916).

Male: 5 mm. long by 280u wide. Tail almost conical ending in a small caudal appendage which is 23u long. Testis extending to about the middle of body. One (?) slightly arcuate spicule (?), 250u in length. Caudal papillae observed, one pair preanal and three pairs postanal.

Female: 8 mm. long by 490u wide. Cuticle without striations. Body long and truncated anteriorly, tapering towards the caudal end. Cephalic papillae two pairs. Oesophagus with a corpus as wide as the head and a globose bulb, 140u in diameter. Anus 252u from posterior extremity; tail attenuated. One (?) ovary, reflexed anteriorly; the oviduct running posteriad to about three quarters of the body length. Vulva in the middle of body. Eggs oval, 84u long by 70u wide, numerous; segmented before deposition.

Host: "Spiroptrentus mentaweiensis Silv."

Location: Intestine.

Distribution:

These two species were described together with four others by Fahrenholz in 1936 (14). The figures given by him which are reproduced in the present paper, are apparently diagramatic. His observations cannot be relied upon not only because of the doubtful nature of his diagrams but the doubtful nature of his descriptions. He has described only one spicule in both species and one ovary in one of them. All species belonging to this group have two ovaries and two spicules. Moreover, from his diagrams it appears that the worms actually did possess two spicules. Under these circumstances the present author feels justified in keeping both these species as species inquirenda in the genus Dudelenia where probably they belong. Railliet and Henry (15) proposed the genus Haplacis to contain these species primarily because they were described with one spicule. The author strongly feels that there has been an error in observation and therefore there is no need for this genus.

Key to the Species of the Genus Dudekemia

1. Tail of male conical, less than 200u in length.....2
   Tail of male attenuated or attenuated filiform, much more than 200u in length..... 5

2. Male caudal papillae 15 pairs, eggs 102u long by 30u wide.....D. multipapillata
   Male caudal papillae less than 10 pairs, eggs about 70 to 80u long by 52 to 60u wide.....3

3. Caudal papillae 6 pairs; male tail slightly attenuated, 170u long.....D. multispinosa
   Caudal papillae more than 6 pairs; male tail very short, less than 100u in length.....4

4. Spicules with a reticular network in their middle third, light caudal alae present ... D. brevicaudata
   Spicules without any reticulate network, caudal alae absent ..... D. robusta

5. Spicules with "wing-like" structures at their distal ends; male caudal papillae 7 pairs...D.falcata
   Spicules without any "wing-like" structures at their distal ends; male caudal papillae more than 7 pairs. ,.....6

6. Male caudal papillae 3 pairs.....D.acuminata
   Male caudal papillae more than 3 pairs 7

7. Spicules 690 to 730u long; male caudal papillae 9 pairs.....D.subulata
   Spicules 130 to 240u long; male caudal papillae 12 pairs .....D.inermis

DISCUSSION

The genus Dudekemia(20) was proposed by Artigas (5) to accommodate species not having a "spermatheca" thus far contained either in the genus Isacis Lespes or in Rhigonema Cobb. This brought into the new genus Rhabditis acuminata d'Udekem, 1859; Isacis multipapillata Skrjabin, 1916; I. falcata Artigas, 1926;

I. subulata Artigas, 1926; and I. robusta Walton, 1927. Artigas (5) added three more species to his new genus, calling them D. multisinosa, D. brevicaudata and D. inermis. Thus the genus now contains eight species. I. silvestrii Parona, 1896, and I. modiglianii parona, 1896, have been considered as species inquirenda due to lack of proper description and adequate diagrams.

LEGENDS

Figure 2

A-C *Dudekemia multispinosa*

A. Female, entire.
B. Female, head end, highly magnified.
C. Female, en face view.
D. Ovejector.
E. Egg.
F. Male, tail, lateral view.
G. Spicules.

H-J. *D. acuminata*

H. Female, entire.
I. Female, genital organs.
J. Male, tail, lateral view.

K-M *D. multimamillata*

K. Male, oesophageal region.
L. Male, tail, lateral view.
M. Male, tail, ventral view.

N-O *D. falcata*

N. Female, anterior region.
O. Male, tail, lateral view.

D. subulata

P. Male, tail, ventral view.

(A-G after Artigas, 1930; H-J after d'Udekem, 1859; K-M after Zhurjakin, 1916; N-P after Artigas, 1926).

LEGENDS

Figure 3.

A-D Dudekenia robusta

A. Female, Oesophageal region.
B. Female, tail.
C. Ovejector.
D. Male, tail, Lateral view.

E-H D. brevicaudata

E. Female, oesophageal region.
F. Male, tail, lateral view.
G. Male, tail, ventral view.
H. Male, en face view.

I-J. D.ineme

I. Female, Oesophageal region.
J. Male, tail, ventral view.

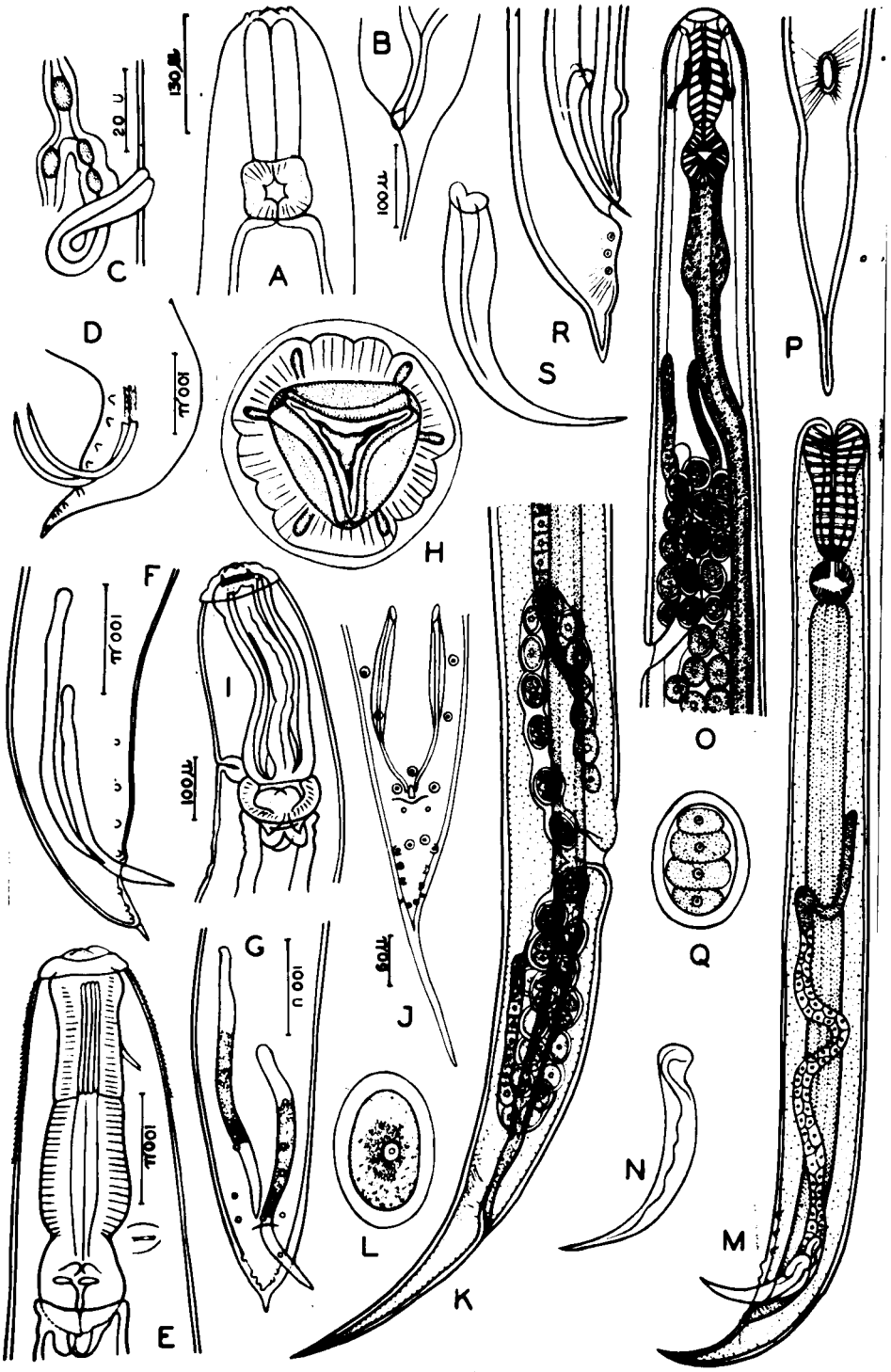
K-N.(?) D. silvestrii

K. Female, posterior part of body.
L. Egg.
M. Male, entire.
N. Spicule.

O-S (?) D. modiglianii

O. Female, anterior half of body.
P. Female, tail.
Q. Egg.
R. Male, tail, lateral view.
S. Spicule.

(A-D after Walton, 1927; E-J after Artigas, 1930; K-S after Perroncito, 1896.)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SUBFAMILY ICTHYOCEPHALINAE ARTIGAS, 1929

Subfamily diagnosis: Rhigonematidae: Mouth surrounded by two well developed lips, one dorsal and the other ventral; cephalic papillae four; amphids present. Buccal cavity large, forming a bulb-like structure. Corpus short and narrow, appearing like an isthmus and connecting the buccal bulb with the oesophageal bulb. Oesophago-intestinal valves very prominent. Two ovaries. Vulva about middle of body. Male with two spicules; gubernaculum absent.

Type genus: Ichthyocephalus Artigas, 1926

GENUS ICTHYOCEPHALUS ARTIGAS, 1926

Generic diagnosis: Icthyocephalinae: Cuticle with fine transverse striations. Male and female having similar characters in the anterior part of the body. Mouth surrounded by two lips, one dorsal and the other ventral, the dorsal lip being more marked. Buccal cavity opening in the form of a transverse slit. Buccal cavity very characteristic, large and in the form of a cephalic bulb containing cuticular modifications internally, being connected with the oesophageal bulb through a narrow intermediate part; the bulbar opening into the intestine being guarded by three very long valves. Vulva at about middle of body; two ovaries, opposed; uteri divergent; ovejector long and directed anteriorly. "Spermatheca" absent. Eggs large, oval, having a smooth shell. Tail of female conical to conically attenuated. Tail of male conical. Two equal spicules; gubernaculum absent; caudal papillae where known four pairs preanal and four pairs postanal.

Type species: Icthyocephalus icthyocephalus Artigas, 1926.

1. Icthyocephalus icthyocephalus Artigas, 1926.

Specific diagnosis: Icthyocephalus:

Male: Not known.

Female: 5 mm. long by 320u in maximum width. Cuticle with fine transverse striations. Mouth opening in the form of a transverse slit, 130u long, guarded by two lips, one dorsal and the other ventral, the dorsal lip being more prominent. The buccal cavity forming a bulbous structure, 230u long by 200u wide, containing teeth-like cuticular formations, and communicating with the posterior oesophageal bulb through a narrow intermediate part, 46u in length. Oesophageal bulb 115u long by 130u wide, its opening into the intestine being guarded by three very long valves. Anus 680u from posterior extremity, tail attenuated. Vulva between middle and posterior third of body, 3.21 mm. from the anterior end. Two ovaries, opposed; uteri divergent. Ovejector 410u long, directed anteriorly. Eggs numerous, relatively large, oval, 142 to 146u long by 100 to 120u in width.

Host: Myriapoda

Location: Intestine.

Distribution: Sao Paulo, Higuainhos (Brazil).

2. Ichthyocephalus articasi Almeida, 1933.
(= Ichthyocephalus articus).

Specific diagnosis: Ichthyocephalus:

Male: 1.79 to 1.93 mm. long by 130 to 140u in maximum width. General characters of body same as

in female. Anus 100 to 120u from posterior extremity; tail short and conical, narrowing suddenly. Two equal spicules, each measuring 200 to 220u in length, with their proximal extremity dilated into a knob-like structure and their distal end bifid and sharp. Caudal papillae eight pairs; four pairs preanal and four pairs postanal. Caudal alae rudimentary.

Female: 2 to 2.2 mm. long by 160 to 170u in maximum width. Buccal cavity large, forming a bulb, 120 to 140u long by 90 to 100u in maximum width. Middle piece 70 to 75u long; oesophageal bulb 80 to 100u long by 80 to 100u wide. Anus 160 to 180u from posterior end of body; tail almost conical. Vulva between middle and posterior third of body; 1.35 mm. from the anterior end. Two ovaries, opposed; uteri divergent. Eggs relatively few in number, oval and with a thin shell, 85 to 88u long by 70 to 75u in width.

Host: Myriapoda.

Location: Intestine.

Distribution: Brazil.

Key to the Species of the Genus Ichthyocephalus

1. Tail attenuated; eggs large, 142 to 146u long by 100 to 120u wide.....I. ichthyocephalus

2. Tail almost conical; eggs comparatively small, 85 to 88u long by 70 to 75u wide.....I. artigasi

LEGENDS

Figure 4

A-C *Icthyoceophalus icthyocephalus*

A. Female, entire.
B. Female, oesophageal region (dorsal view)
C. Female, oesophageal region (lateral view).

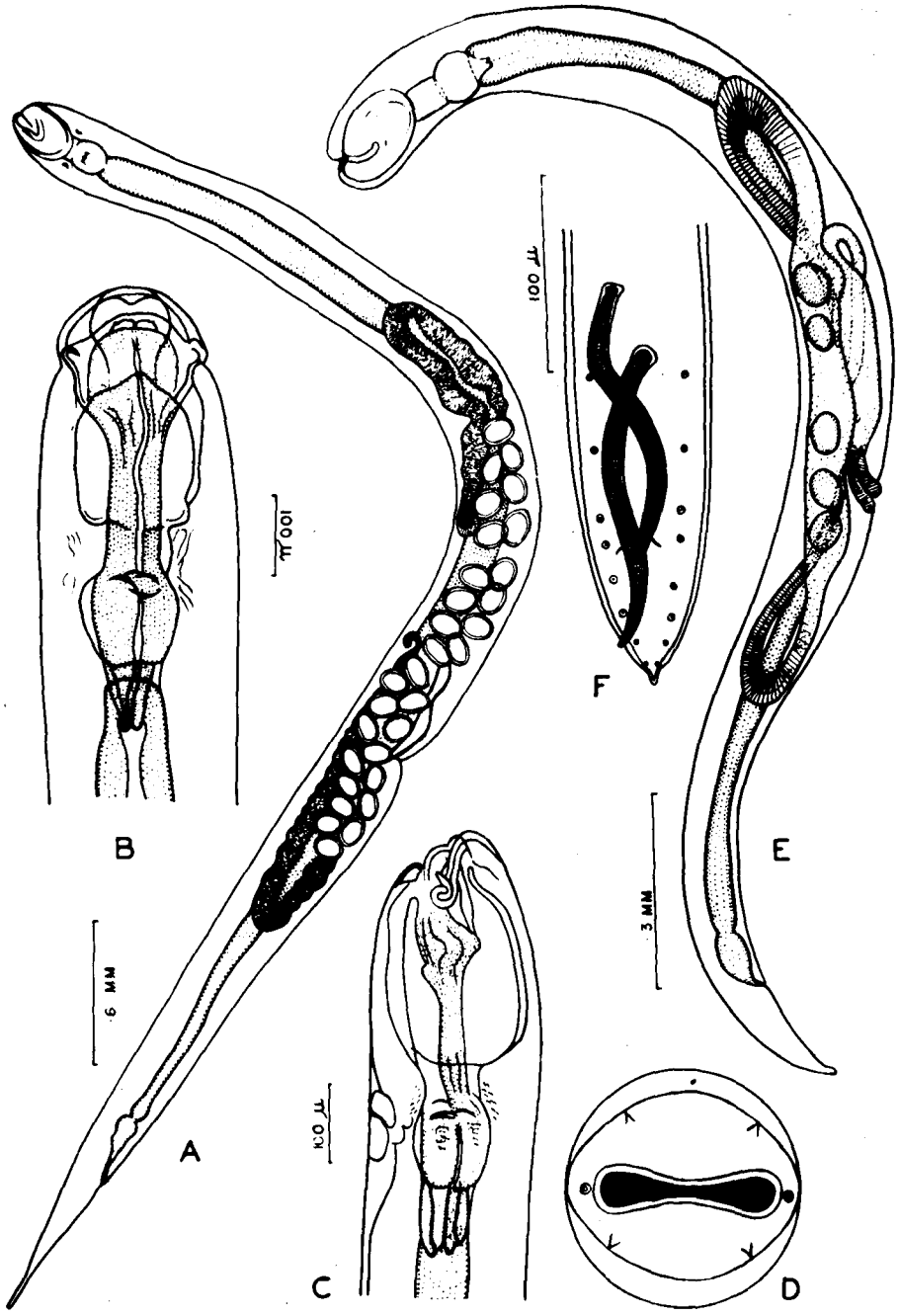
Icthyocephalus sp.

D. Female, *en face* view.

E-F *I. artigasi*

E. Female, entire.
F. Male, tail, ventral view.

(A-C after Artigas, 1926; D after Chitwood and Chitwood 1937; E-F after Almeida, 1933.)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